Santa Fe Regional ITS Architecture
Update

Final Report
Draft

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Prepared for:

Santa Fe Metropolitan Planning Organization (SFMPO)

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Revision History

Filename	Version	Date	Authors	Comment
Santa Fe Regional ITS Architecture Document	1.00	4/8/05	B. Eisenhart, T. Harris	Initial Release of Architecture
Santa Fe Regional ITS Architecture v2.docx	2.00	12/30/11	B. Eisenhart	Final Update for Version 2
Santa Fe Regional ITS Architecture v3 draft 1.docx	3.00.1	06/30/19	B. Eisenhart	Draft Update for Version 3

1. Introduction

The ***Santa Fe Regional Intelligent Transportation Systems (ITS) Architecture*** is a roadmap for transportation systems integration in the Santa Fe region over the next 20 years. The architecture has been developed through a cooperative effort by the region's transportation agencies, covering all modes and all roads in the region. The architecture represents a shared vision of how each agency's systems will work together in the future, sharing information and resources to provide a safer, more efficient, and more effective transportation system for travelers in the region.

The architecture is an important tool that will be used by:

- Operating Agencies to recognize and plan for transportation integration opportunities in the region.
- Planning Agencies to better reflect integration opportunities and operational needs into the transportation planning process.
- Other organizations and individuals that use the transportation system in the region.

The architecture provides an overarching framework that spans all of these organizations and individual transportation projects. Using the architecture, each transportation project can be viewed as an element of the overall transportation system, providing visibility into the relationship between individual transportation projects and ways to cost-effectively build an integrated transportation system over time.

The architecture is described by this document, by a RAD-IT (formerly known as Turbo Architecture) database, and by a hyperlinked website that can be found at http://consystec.com/santafe2019/web/,

This architecture is not static, but will be revised and updated as plans change, ITS projects are implemented, and the ITS needs and services evolve in the region. This document, which describes the architecture, is a "living document" that will be updated each time the architecture is updated.

1.1. Purpose

The Santa Fe Regional ITS Architecture represents a consensus blueprint for ITS investments in the region. The Regional ITS Architecture starts by identifying the potential ITS agencies (stakeholders) within the region. It goes on to define possible integration opportunities between agencies within the region and identifies how cooperation between the agencies in the deployment of ITS systems can be used to satisfy the region's surface transportation needs.

This Regional ITS Architecture can be used to efficiently structure implementations of ITS technologies. By creating a long-range plan for the implementation of these systems and technologies, agencies can:

- Prepare for future expansion;

- Develop coordinated deployment of ITS;
- Leverage funding; and
- Identify standard interfaces.

In addition to structuring implementations of ITS technologies, the Regional ITS Architecture allows the transportation agencies in the region to comply with the FHWA Rule/FTA Policy on Architecture and Standards. The FHWA Final Regulation, 23 CFR 940, (and corresponding FTA policy) to implement Section 5206(e) of the TEA-21 requires that ITS projects funded through the Highway Trust Fund conform to the ARC-IT and applicable standards. The Regulation/Policy requires that the ARC-IT be used to develop a local implementation of the ARC-IT, which is referred to as a "Regional ITS Architecture." This Regional ITS Architecture allows identified existing and planned projects in the region to be fully compliant with this Regulation/Policy, which will facilitate the approval of federal funds to support ITS projects in the region.

1.2. Document Overview

This document is organized into twelve main sections. Section 1 provides introductory information. Section 2 describes the process used to develop the regional ITS architecture. Section 3 gives a brief introduction and overview of ARC-IT (formerly known as the National ITS Architecture), and how it relates to this Regional ITS Architecture. The stakeholders are identified in Section 4, while their systems are inventoried in Section 5. The transportation services, information exchanges, functional requirements, and standards associated with the systems are discussed in Sections 6, 7, 8, and 9, respectively. Section 10 describes regional projects and sequencing, while Section 11 discusses the agreements needed between stakeholders to maximize system benefits. Finally, Section 12 provides guidance on using the regional ITS architecture and Section 13 summarizes the architecture maintenance plan.

1.3. Scope of the Architecture

The geographic scope of the architecture is the entirety of Santa Fe County, NM. This regional ITS architecture interfaces with the following statewide or regional ITS architectures:

- Albuquerque Metropolitan Planning Area (AMPA) Regional ITS Architecture
- New Mexico Statewide Architecture

The timeframe considered is a 20-year outlook for ITS activities in the region. This means that the architecture addresses existing ITS systems as well as those planned for development over the next 20 years. It represents a snapshot of the currently anticipated projects based on information from stakeholders. As such, the architecture will require regular updates to ensure that it maintains accurate representation of the region.

The architecture covers services across a broad range of ITS, including traffic management, public transportation, commercial vehicle operations, public safety, maintenance and construction, parking management, vehicle safety, traveler information, sustainable travel, data management, and weather

2. Regional ITS Architecture Development Process

The Santa Fe Regional ITS Architecture was originally developed in 2005. The architecture underwent its first major update in 2010-2011. This version (version 3) represents the third major update of this architecture, being completed in 2018-2019. The update process used for version 3 process is described in Section 2.1.

2.1. Architecture Update Process

The update of the Santa Fe Regional ITS Architecture followed the following five steps.

1) Conduct Stakeholder Interviews

Key stakeholder representatives were interviewed via telephone to understand what changes have taken place since the architecture was last updated in 2011. The interviews focused on projects containing ITS services (using the project list from the original architecture as a starting point). Interviews were conducted with representatives of NMDOT District 5, City of Santa Fe, Santa Fe County, Santa Fe Trails, Santa Fe MPO, and the RECC. The notes from the interviews were used as the starting point for development of the draft update architecture.

2) Develop a Draft ITS Architecture Update

Using the information collected during the stakeholder interviews, the architecture material was updated, including

- Stakeholders,
- Elements,
- Customized Service Package diagrams of all services
- List of planned ITS Projects
- **Hold Stakeholder Workshop**

A half-day stakeholder workshop was held on March 21, 2019 to review the draft architecture with key regional stakeholders. The objectives of the workshop were to:

- Provide training for regional stakeholders on ITS architecture – what it is and how to use it.
- Review the draft ITS architecture in order to get concurrence from the stakeholders that it represents their existing and planned ITS deployments. The review covered stakeholders, inventory, services, operational concept (stakeholder roles and responsibilities), interfaces (as shown in the customized service package diagrams), projects and agreements.
- Provide discussion of use and maintenance of the architectures.

3) Develop Updated Draft ITS Architecture

Following the workshop, a complete update of the architecture was created including the following baseline outputs:

- RAD-IT File
- Regional ITS Architecture Document
- Customized Service Package Diagrams
- Hyperlinked website containing the architecture details.

Following a review period, a telecom with key stakeholders was held to review the changes and obtain comments.

4) Develop Final ITS Architecture

Following the receipt of comments, a final set of architecture update products were created. The final updated baseline is available on the website. The RAD-IT file and Customized Service Package file will also be provided.

2.2. Requirements of the Final FHWA Rule and FTA Policy on Architecture

The FHWA Regulation (23CFR 940) and FTA Policy on Intelligent Transportation System Architecture and Standards, which took effect on April 8, 2001 defines a set of requirements that regional ITS architectures should meet. Table 1 shows how the requirements of the rule are met by the outputs developed for the Santa Fe Regional ITS Architecture.

Table 1: Mapping of Requirements to Architecture Outputs

Regional ITS Architecture Requirements	Where Requirements documented
Description of region	Geographic definition, as well as timeframe and scope of services are given in Section 1.3 of this document.
Identification of participating agencies and other stakeholders	Listing of stakeholders and their definitions is given in Section 4.1 of this document. An inventory of the elements operated by the stakeholders is contained in Section 5 of this document. The same information is also available in the hyperlinked web site and in the RAD-IT database.
An operational concept that identifies the roles and responsibilities of participating agencies and stakeholders	The operational concept is defined in Section 4.2 of this document.
A list of any agreements (existing or new) required for operations	A discussion of existing and needed new agreements is given in Section 11 of this document
System functional requirements;	The functional requirements of the ITS systems are described in an overview in Section 8 of this document, and are found on the website. Functional objects are defined in the RAD-IT database
Interface requirements and information exchanges with planned and existing systems and subsystems	The Interfaces and information flows are described in an overview in Section 7 of the document, and are described

Regional ITS Architecture Requirements	Where Requirements documented
	in detail in the hyperlinked web site and in the RAD-IT database.
Identification of ITS standards supporting regional and national interoperability	The identification of standards for ITS in Santa Fe region is discussed in Section 9 of this document and can also be found on the interface pages of the hyperlinked web site.
The sequence of projects required for implementation	Projects and their sequencing for Santa Fe region are covered in Section 10 of this document and can also be found on the hyperlinked website.

3. ITS Architecture Concepts

The Santa Fe Regional ITS Architecture is an example of a regional ITS architecture, which has been defined by FHWA CFR 940 as a "regional framework for ensuring institutional agreement and technical integration for implementation of ITS projects". Regional ITS architectures are developed in order to provide a guide for the integration of transportation systems. This Regional ITS Architecture is based upon ARC-IT/ARC-IT Version 8.2.

In 2017, the National ITS Architecture was renamed *Architecture Reference for Cooperative and Intelligent Transportation*, abbreviated to *ARC-IT*. The term *ARC-IT* will be used throughout the remainder of this document. A complete description of ARC-IT can be found at *https://local.iteris.com/arc-it/*.

The following are the core components of the ITS architecture:

- Organizations
- Systems operated
- Services provided
- Functions performed
- Information exchanged

The organizations that operate systems in the region covered by the architecture are referred to as **stakeholders**. These are public agencies, private organizations or the traveling public with a vested interest, or a "stake" in one or more transportation elements within a regional ITS architecture.

The systems operated by the stakeholders are referred to as **elements**. In the Santa Fe Regional ITS Architecture the elements represent actual systems, such as the City of Santa Fe Traffic Operations Section. An element may also represent field devices, for example the element City of Santa Fe Traffic Signals. A more thorough discussion of the architecture elements is contained in Section 5. The Regional ITS Architecture uses a set of common concepts or terms drawn from ARC-IT to describe the parts of the architecture. Since these ARC-IT terms show up repeatedly in later discussion they will be defined here.
ARC-IT uses two terms to describe the systems that make up an architecture. They are:

- **Subsystems**, which represent the primary systems described by the architectures. For example, the TMC element mentioned above represents a regional ITS architecture example of the Traffic Management Center subsystem defined in ARC-IT. ARC-IT version 8.2 defines 42 subsystems. These are divided into five classes, representing different categories of ITS systems: center, field, vehicle, traveler, and support.

- **Terminators**, which represent systems that are on the boundary of the architecture. In general, only interfaces to the terminators are described in the national architectures. An example of a terminator from ARC-IT is the Weather Service. ARC-IT version 8.2 defines 97 terminators.

As a part of developing a regional ITS architecture, each element of the region is mapped to the subsystems and/or terminators that most closely define the functions of the element. This mapping allows the regional version to use the details associated with the subsystems and terminators in ARC-IT. As an example, the element in the Regional ITS Architecture called National Weather Service is mapped to ARC-IT terminator Weather Service.

The information exchanged between elements (in the Regional ITS Architecture) or between subsystems and terminators in ARC-IT is described by **information flows**. There are hundreds of these flows defined in ARC-IT, and it is this information that is used to create the interface definitions in the Regional ITS Architecture. For example, in Figure 1, the top two boxes show an interface between two subsystems, with its information flows defining the exchange of information. A corresponding interface in Regional ITS Architecture is shown in the bottom two boxes.

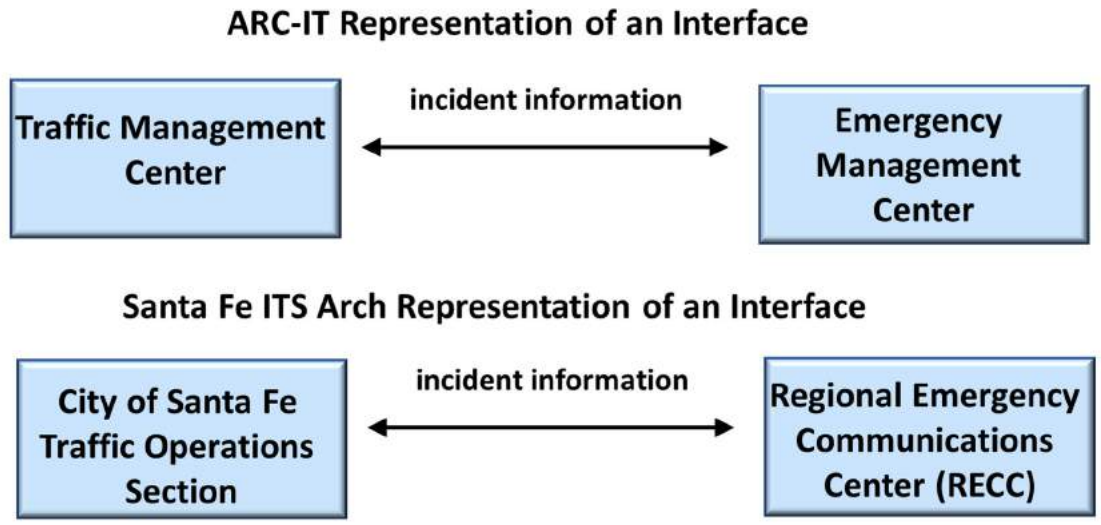


Figure 1. Information Flows

By mapping the Regional ITS Architecture elements (e.g., City of Santa Fe Traffic Operations Section) to ARC-IT physical objects (e.g. Traffic Management Center), the interfaces defined in ARC-IT can be used as the basis for defining the interfaces in the Regional ITS Architecture.

The next key concept used by the architectures is that of **service packages**. These represent slices of an architecture that provide a transportation service. In ARC-IT, these service packages are combinations of subsystems and information flows that are used to provide the service. An example of ARC-IT service package is shown in Figure 2. This shows the subsystems and information flows (some of which go to terminators) that perform the collection and distribution of traffic flow and traffic images used to monitor a road network. In the development of Regional ITS Architecture, a set of customized service packages were created that define the elements and interfaces used to provide the service in Regional ITS Architecture.

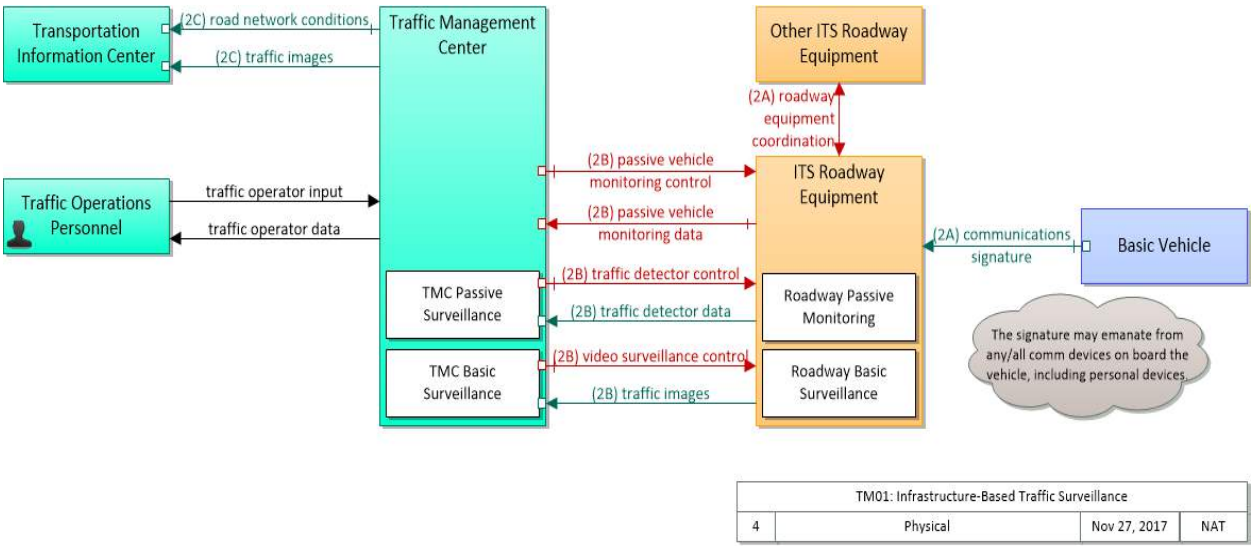


Figure 2. Example of ARC-IT Service Package

Figure 3 shows one of the customized service packages, in this case for the City of Santa Fe. This diagram shows how the city might implement this service.

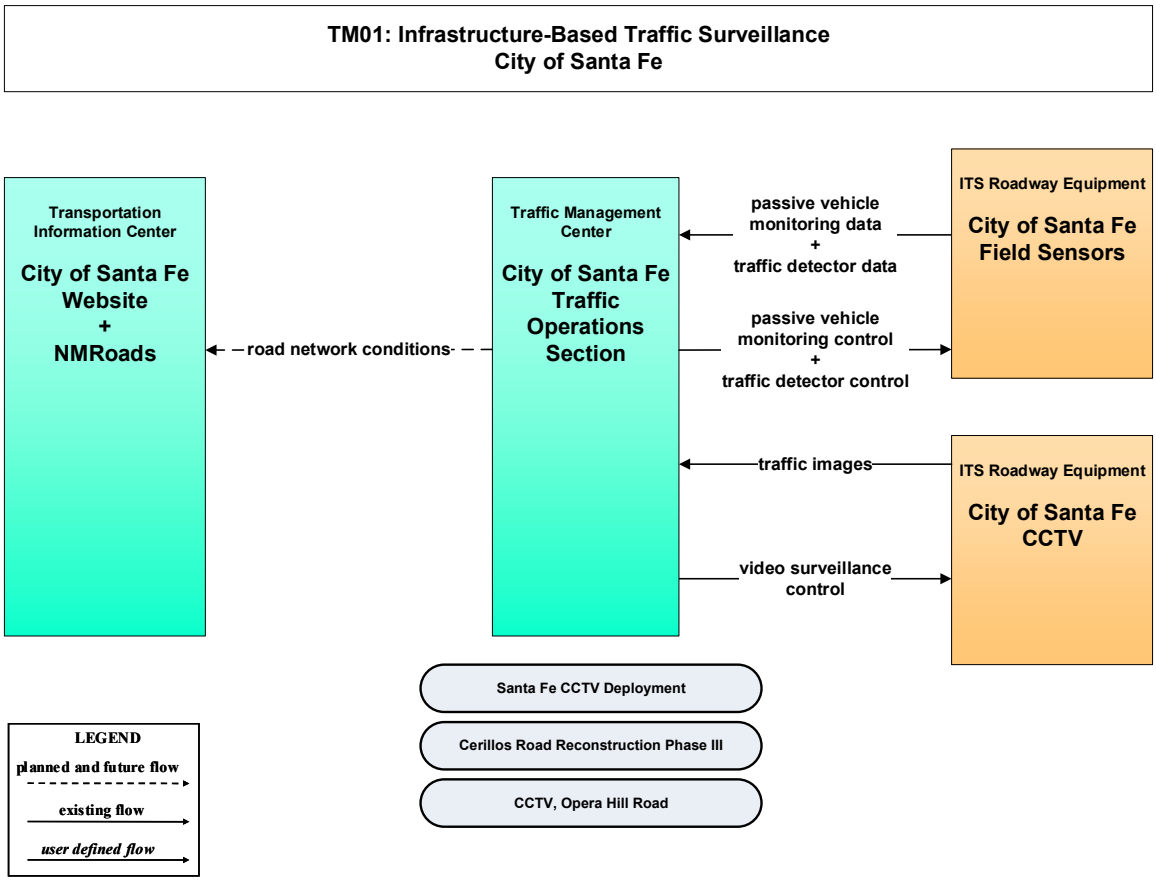


Figure 3. Example of a Customized Service Package

Notice that the customized service package includes only some of the interfaces that were in the ARC-IT service package. It does not include interfaces to other ITS roadway equipment or personnel. Elements mapping to these are not planned for the near future in the Santa Fe region and thus are not included in the Regional ITS Architecture.

One final concept to mention relates to the functions performed by the elements in the architecture. ARC-IT has the concept of a **Functional Objects (FO)**, which defines a piece of functionality within a subsystem. For example in Figure 2, TMC Basic Surveillance is a function (or functional object) that is performed by the Traffic Management Center in performing the Infrastructure Based Traffic Surveillance service. In the Regional ITS Architecture functions have been identified for the key elements using a mapping of functional objects to each element. For example, the City of Santa Fe Traffic Operations Section (shown in Figure 3) will implement the TMC Basic Surveillance functional object (shown in Figure 2 as functionality in the Traffic Management Center subsystem). Further information regarding how functions are defined for each element is found in Section 8.2 on Functional Requirements.

4. Identification of Stakeholders

4.1. Regional Stakeholders

Stakeholder coordination and involvement is one of the key elements of the development of a regional ITS architecture. Because ITS often transcends traditional transportation infrastructure, it is important to consider a range of stakeholders beyond the traditional traffic, transit, and maintenance areas. In addition, it is important to consider stakeholders at a regional level or stakeholders in adjoining regions.

The Santa Fe Regional ITS architecture includes a wide range of stakeholders. Many of these stakeholders were active partners in the update of the architecture. The following list of agencies were represented and provided their inputs on the architecture:

- Santa Fe MPO
- City of Santa Fe Public Works
- Santa Fe Trails
- Santa Fe RECC
- Santa Fe County
- NMDOT
- North Central Regional Transit District (NCRTD)

Table 2 identifies the stakeholders that own or operate elements within the Regional ITS Architecture. The table provides a name and description of the agency, department, or organization represented by the stakeholder. This table includes the full range of stakeholders assigned to the all of the elements in the architecture.

Table 2: Stakeholders

Stakeholder Name	Stakeholder Description
Albuquerque Transit	A transit provider that offers linked service to the city of Albuquerque for transit providers within the Santa Fe region.
Bureau of Indian Affairs	Bureau of Indian Affairs provides some emergency services for those pueblos without their own departments.
City of Santa Fe	Represents overall the municipal government and miscellaneous departments for the City of Santa Fe.
City of Santa Fe Fire Department	Provides fire, rescue and emergency medical services to the City of Santa Fe.
City of Santa Fe Police Department	Law enforcement provider for the City of Santa Fe.
City of Santa Fe Public Works Department	Department responsible for the overall management and control of vehicular and pedestrian traffic within the City. The Public Works Department includes the following six divisions: Engineering (including Traffic Engineering and Traffic Operations sections), Property Control, Solid Waste Management, Streets, Drainage and Fleet Management, Transit (Santa Fe Trails), and Transportation Operations).
City of Santa Fe Senior Services	A transit authority that operates within the City of Santa Fe that provides demand response and paratransit services to seniors.
City/County of Santa Fe	Stakeholder that represents a joint partnership of the City of Santa Fe and Santa Fe County regarding the ownership and operation of their joint Emergency Operations Center.
Commercial Vehicle Operators	Private commercial vehicle operators
Correctional Facilities	Federal, State and County correctional facilities within the Santa Fe region.
County Emergency Management Agencies	Coordination of mitigation and response for natural and man-made disasters and emergencies
Department of Game and Fish	The state department responsible for managing the region's wildlife population, regional fish population, and the state laws governing each.
Electric Charging Station Operators	Operators of Electric Vehicle Charging Stations
Financial Institution	Financial and banking institutions that play a role in the transfer of funds for fare collection as well as for other fee based transportation services.
Independent School Districts	Includes public schools throughout the Santa Fe Region.
Local Media	Includes both print (newspaper) and broadcast (TV, radio) news media.
Local Transit Operators	Local transit agencies (public or private) that service the Santa Fe region not explicitly called out in this architecture.
New Mexico Department of Public Safety - DPS	New Mexico Department of Public Safety includes the State Police and the Motor Transport Division.
New Mexico General Services Department	The New Mexico General Services Department provides, through the Information Systems Division (ISD), data processing, application

Stakeholder Name	Stakeholder Description
	development, telecommunications and radio communications resources and services to the State of New Mexico.
NMDOT - New Mexico Department of Transportation	The Statewide stakeholder for the New Mexico Department of Transportation.
NOAA	National Oceanic and Atmospheric Administration (National Weather Service).
North Central Regional Transit District	The North Central Regional Transit District (NCRTD) is the first regional transit district certified in New Mexico. It covers the area from Santa Fe to Espanola to Los Alamos including the pueblos in this area.
Operation Respond Institute	The Operation Respond Institute (ORI) is a not-for-profit, public/private partnership serving the emergency response community with time and lifesaving technology tools to combat safety and security incidents occurring on North American railroads and highways.
Other Counties	Other counties in the region
Private Concierge Service Providers	Private concierge service providers within the Santa Fe region. Includes Onstar, etc.
Private Consultants	Private consultants within the Santa Fe region.
Private Equipment Repair Providers	Private providers of equipment repair facilities that are contracted by the city, county, or other municipalities within the Santa Fe region.
Private Parking Payment Services	Private payment processing providers
Private Sector Traveler Information Service Providers	Local, regional and national information service providers that provide travel information, including local media (print, TV and radio), Includes internet sites, service bureaus, etc
Private Taxi Providers	Private companies providing taxi service.
Private Tow/Wrecker Providers	Private companies that provide tow or wrecker services for regions in the state.
Private Traffic Data Providers	Private organizations that collect traffic data
Private Transportation Providers	Other private transportation providers not specifically called out within the region.
Private Travelers	Traveling public accessing various modes of transportation, including surface street, air, rail/transit, and non-motorized.
Private Weather Service Providers	Weather information providers that provide regional weather information to regional agencies.
Private/Public Ambulance Providers	Private ambulance providers within the region.
Rail Operators	Operators of private rail systems (e.g. Santa Fe Southern), including passenger and freight.
RECC Joint Powers Agreement	The Regional Emergency Communications Center is chartered by a joint powers agreement between City of Santa Fe and Santa Fe County

Stakeholder Name	Stakeholder Description
Regional Medical Center	Hospital/trauma centers in the region.
Regional Public Safety Agencies	Other public safety agencies not specifically called out in the architecture.
Rio Metro	Regional transit district for central New Mexico, operating RailRunner.
Santa Fe Convention and Visitors Bureau	Organization responsible for event information in the municipalities of the Santa Fe region.
Santa Fe County Public Safety Agencies	Santa Fe County sheriff and fire agencies.
Santa Fe County Public Works	Santa Fe County agency responsible for maintaining county roads and bridges in the Santa Fe Region.
Santa Fe MPO	The Santa Fe Metropolitan Planning Organization is the transportation planning agency for the Santa Fe Region.
Santa Fe Trails	A Transit service provider within the Santa Fe region that includes fixed route service and paratransit/demand response service.
Town of Taos	Represents Town of Taos government, specifically related to Taos Express Shuttle.
Transit Partnership	Stakeholder group involved in Multimodal Transit Center
Tribal Councils	Tribal government, which is responsible for providing emergency services on the pueblos
Volunteer Fire Departments	Volunteer fire departments that operate within the region.

The stakeholders listed in Table 2 represent a mix of specific agencies or organizations and generic names used to represent a variety of stakeholders. Examples of specific agency or organizations would be City of Santa Fe Public Works. An example of a generic stakeholder name would be Private Travelers, which represents all individuals traveling through the region.

4.2. Operational Concept

An Operational Concept documents each stakeholder's current and future roles and responsibilities in the operation of the regional ITS systems. The operational concept documents these roles and responsibilities across a range of transportation services. The following service areas appear in the Santa Fe Regional ITS Architecture:

- **Surface Street Management**: Arterial monitoring and management, including the development of signaling systems that react to changing traffic conditions and provide coordinated intersection timing over a corridor, an area, or multiple jurisdictions.
- **Freeway Management**: the development of systems to monitor highway traffic flow and roadway conditions. Includes systems to provide information to travelers on the roadway.

- **Incident Management**: the development of systems to provide rapid and effective response to incidents. Includes systems to detect and verify incidents, along with coordinated agency response to the incidents.
- **Transit Management**: the development of systems to more efficiently manage fleets of transit vehicles or transit rail. Includes systems to provide transit traveler information both pre-trip and during the trip.
- **Traveler Information**: the development of systems to provide static and real time transportation information to travelers.
- **Emergency Management**: the development of systems to provide emergency call taking, public safety dispatch, and emergency operations center operations.
- **Maintenance and Construction**: the development of systems to manage the maintenance of roadways in the region, including winter snow and ice clearance. Includes the managing of construction operations.
- **Data Management**: the development of systems to collect transportation data for use in non-operational purposes (e.g. planning and research).
- **Sustainable Travel:** the development of systems that reduce the impact of the transportation network on the environment. An example is the development of electric charging stations to support zero emission vehicles.
- **Parking Management**: the management of parking operations, including space availability monitoring and dissemination and parking payment.

Table 3 identifies the roles and responsibilities of key stakeholders for a range of transportation services.

Table 3: Stakeholder Roles and Responsibilities

Transportation Service	Stakeholder	Roles/ Responsibilities	Status
Surface Street Control	NMDOT	• Operate traffic signal systems on state owned arterials • Interconnect with signal systems operated by counties or municipalities adjoining the NMDOT systems. • Provide signal preemption for emergency vehicles • Collect road weather information	Existing Planned Existing Existing
	City of Santa Fe Public Works	• Operate traffic signal systems for City of Santa Fe. • Interconnect with signal systems operated by NMDOT and Santa Fe County adjoining the city • Provide signal preemption for emergency vehicles • Perform bicycle detection to support traffic signal operations. • Collect road weather data from city streets.	Existing Planned Existing Planned Planned
	Santa Fe County Public Works	• Operate traffic signal systems for Santa Fe County (future). • Interconnect with signal systems operated by NMDOT and municipalities adjoining the Santa Fe County systems (future).	Existing Planned

Transportation Service	Stakeholder	Roles/ Responsibilities	Status
Freeway Management	NMDOT District 5	• Monitor traffic sensors on highways. • Determine travel times for highways. • Collect road weather information. • Operate traffic information devices on freeway (e.g. DMS and Highway Advisory Radios - HAR). • Provide traffic information reports to other agencies (future).	Existing Existing Planned Existing Planned
Incident Management	NMDOT District 5	• Perform network surveillance for detection and verification of incidents • Dispatch Freeway Service Vehicles • Provide incident information to travelers via traffic information devices on freeways (e.g. DMS) • Coordinate maintenance resource response to incidents with state police and RECC. • Coordinate operations with City of Santa Fe during scheduled events.	Existing Planned Existing Planned Planned
	NMDOT Signal Lab	• Adjust signal timing patterns in response to incidents.	Existing
	City of Santa Fe Public Works	• Perform incident detection and verification for arterial streets in the City of Santa Fe through video surveillance. • Adjust signal timing patterns in response to incidents. • Coordinate incident response with City of Santa Fe Public Safety (Police, Fire, and EMS). • Operate Dynamic Message Signs on City of Santa Fe arterials to inform travelers of incidents (future) • Coordinate maintenance resources for incident response with NMDOT and county. • Coordinate operations with NMDOT during scheduled events.	Existing Existing Planned Planned Planned Planned
	Regional Emergency Communications (RECC)	• Receive emergency calls for incidents within the City of Santa Fe and Santa Fe County • Dispatch Police, Fire, and EMS to incidents within the City and Sheriff, Fire, and EMS to incidents within Santa Fe County. • Provide incident information to traffic and other public safety agencies. • Coordinate incident response between Santa Fe County public safety and City of Santa Fe public safety. • Coordinate incident response with public safety in surrounding counties.	Existing Existing Planned Planned Planned
	City of Santa Fe Fire	• Respond to Hazmat incidents with City of Santa Fe.	Existing
	New Mexico Department of Public Safety (includes State Police)	• Receive emergency calls from cell phones for incidents within the region. • Dispatch State Police vehicles for incidents on freeways.	Existing Existing

Transportation Service	Stakeholder	Roles/ Responsibilities	Status
		• Coordinate incident response with NMDOT, RECC and municipal public safety.	Planned
	City of Santa Fe Convention and Visitors Bureau	• Provide event information to the public via website.	Existing
Transit Management	Santa Fe Trails	• Provide fixed route bus service for City of Santa Fe. • Provide paratransit service for City of Santa Fe.	Existing Existing
	North Central Regional Transit District	• Provide fixed route bus service for Espanola and surrounding communities.	Existing
	Rio Metro	• Operate Rail Runner Commuter Rail	Existing
	Transit Partnership	Operate Transit Multimodal Center	Existing
	School Districts	• Provide fixed route school bus services to the region.	Existing
Traveler Information	NMDOT District 5	• Disseminate traveler information via NMRoads. Provide traffic and maintenance information for the region to NMRoads • Provide traveler information directly to drivers via DMS. • Provide traveler information to the local print and broadcast media and websites (through Public Information Office).	Existing Existing Existing Existing
	City of Santa Fe	• Provide traffic and maintenance information for City of Santa Fe to the public via website. • Provide traffic and maintenance information for City of Santa Fe to the local media. • Provide information to NMRoads • Provide traveler information directly to drivers via DMS and other technologies.	Planned Existing Planned Planned
	Santa Fe Trails	▪ Provide transit information for Santa Fe Services the public via website ▪ Provide real-time transit information to the public ▪ Provide on-line reservation capability for paratransit services	Existing Planned Planned
	Santa Fe County	• Provide traffic and maintenance information for Santa Fe County to the public via website. • Provide traveler information to NMRoads	Planned Planned
Emergency Management	Regional Emergency Communications (RECC) Stakeholders	• Provide emergency call taking (9-1-1) for unincorporated areas of Santa Fe County and for the City of Santa Fe. • Dispatch Santa Fe County sheriff, fire, and EMS. • Dispatch City of Santa Fe police, fire, and EMS. • Coordinate emergency operations with State Police, county, and municipal public safety.	Existing Existing Existing Existing
	City of Santa Fe Police and Fire	• Develop city emergency preparedness plan • Provide Emergency Operations Center for city responsible for directing emergency operations	Existing Existing

Transportation Service	Stakeholder	Roles/ Responsibilities	Status
		during major emergencies and disasters. (jointly with Santa Fe County)	
	New Mexico Department of Public Safety	• Receive emergency calls from cell phones for incidents within the region. • Dispatch State Police vehicles for emergencies on freeway and other state owned roads. • Coordinate emergency response with NMDOT, Santa Fe County sheriff, City of Santa Fe Police, and other municipal public safety.	Existing Existing Existing
	County Sheriff	• Develop county emergency preparedness plan • Provide Emergency Operations Center for County of Santa Fe responsible for directing emergency operations during major emergencies and disasters (jointly with City of Santa Fe)	Existing Existing
Maintenance Management	NMDOT District 5	• Provide maintenance of state highways in the region including snow and ice control and pavement maintenance. • Manage work zones on state owned roads. • Collect road weather information (future)	•
	NMDOT	• Maintain signalized intersection and other ITS equipment	•
	City of Santa Fe Public Works	• Provide maintenance of arterials in the city including snow and ice control and pavement maintenance. • Maintain signalized intersection and other ITS equipment • Manage work zones in the City of Santa Fe. • Collect road weather information.	•
	Santa Fe County Public Works	• Provide maintenance of County roads including snow and ice control and pavement maintenance. • Maintain signalized intersection equipment.	•
	Municipalities	• Provide maintenance of municipal roads including snow and ice control and pavement maintenance. • Maintains signalized intersection equipment.	•
Data Management	City of Santa Fe	• Collect and archive traffic count data for the City of Santa Fe • Collect and archive accident data for the City of Santa Fe.	Existing Existing
	Santa Fe MPO	• Collect and archive transportation data for region, including traffic count and crash data.	Existing
	NMDOT	• Collect and archive asset information • Collect and archive traffic count data for state owned roads. • Collect and archive crash records for all roads in the state.	Existing Existing Existing
Sustainable Travel	City of Santa Fe	• Deploy and operate electric vehicle charging stations	Planned

Transportation Service	Stakeholder	Roles/ Responsibilities	Status
Parking	City of Santa Fe	• Operate municipal parking facilities	Existing

5. Inventory

Each stakeholder agency, company, or group owns, operates, maintains or plans ITS systems in the region. The Regional ITS Architecture inventory is a list of "elements" that represent all existing and planned ITS systems in a region as well as non-ITS systems that provide information to or get information from the ITS systems. The focus of the inventory is on those systems that support, or may support, interfaces that cross stakeholder boundaries (e.g., inter-agency interfaces, public/private interfaces).

The vast majority of the inventory represents ITS systems in the region, but the inventory does contain some elements that represent systems in adjoining regions. An example of an element in an adjoining region would be the NMDOT Statewide TMC, which represents the statewide traffic management center in Albuquerque. It would interface with traffic elements in region.

Each element in the inventory is described by a name, the associated stakeholder, a description, general status (e.g. existing or planned), and the associated subsystems or terminators from ARC-IT.

5.1. Systems by Stakeholder

Table 4 sorts the inventory by stakeholder so that each stakeholder can easily identify all the relevant elements that are defined in the architecture. For each element in the inventory the table provides an element description and an indication of whether the element exists or is planned.

The majority of elements in the inventory represent a specific existing or planned system. Some examples of specific systems are the NMDOT District 5 TOC and City of Santa Fe Traffic Signal Shop.

Some of the elements represent sets of devices, rather than a single specific system or device. An example of this type of element is the element "City of Santa Fe CCTV". This element represents all of the CCTV that are or will be operated by City of Santa Fe. The element describes the type of field device, not the specific number of devices.

A third type of element in the inventory is a "generic" element that represents all of the systems of a certain type in the region. An example of this type of element is Other County Public Safety Dispatch and PSAP, which represents the police, fire, and EMS emergency dispatch functions for counties adjacent to Santa Fe County. These generic elements have been created for two primary reasons. First, they represent elements with similar types of interfaces, so from a standardization standpoint, describing how one of the planned major elements in the region (e.g. the NMDOT District 5 TOC) interfaces with various public safety dispatch functions would be the same. Second, describing many systems with a single element helps keep the architecture from growing too large.

Table 4: Inventory sorted by Stakeholder

Stakeholder	Element Name	Element Description	Status
Albuquerque Transit	Albuquerque Transit Dispatch	Paratransit and demand response services for Albuquerque Transit.	Existing
Bureau of Indian Affairs	Bureau of Indian Affairs Dispatch	Dispatch function for the Bureau of Indian Affairs (BIA). The BIA provides emergency services for pueblos that do not have their own police forces.	Existing
City of Santa Fe	City of Santa Fe Collection Section	The collections section will perform collections on the parking meters, possibly with vehicle interfaces.	Planned
City of Santa Fe	City of Santa Fe Enforcement Section	Enforcement Section performs parking enforcement.	Existing
City of Santa Fe	City of Santa Fe On-Street Parking Meters	This element represents smart parking meters that have been deployed on city streets.	Existing
City of Santa Fe	City of Santa Fe Parking Division Operations	Parking Division Operations will monitor parking meters and operate parking garages.	Existing
City of Santa Fe	City of Santa Fe Parking Garages	Parking facilities owned and operated by the City of Santa Fe. Includes facilities to be constructed at the Santa Fe Convention Center.	Existing
City of Santa Fe	City of Santa Fe Public Information Office	The office provides the official interface between the City of Santa Fe traffic department and interests outside the department such as the media.	Existing
City of Santa Fe	City of Santa Fe Traffic Counts Program	The traffic count division of the City of Santa Fe who is responsible for collecting all traffic sensor and flow information from the City's ITS field devices.	Existing
City of Santa Fe	City of Santa Fe Website	Transportation information web page for the City of Santa Fe. In the future will include real-time construction, work zone, special event, incident, and traffic information.	Existing
City of Santa Fe	Parking Smart Card	Generalized or special purpose card used for smart parking meters.	Planned
City of Santa Fe	Santa Fe Pickup Dispatch	Santa Fe Pickup is a free shuttle service.	Planned
City of Santa Fe	Santa Fe Pickup Vehicles	Vehicles of the Santa Fe Pickup Shuttle.	Planned

Stakeholder	Element Name	Element Description	Status
City of Santa Fe Fire Department	City of Santa Fe Fire/EMS Vehicles	Represents the ITS equipment (e.g., mobile data terminals) on the City of Santa Fe's Fire and EMS vehicles.	Existing
City of Santa Fe Police Department	City of Santa Fe Accident Database	Crash records database collected by the City of Santa Fe.	Existing
City of Santa Fe Police Department	City of Santa Fe Police Vehicles	Represents the ITS equipment (e.g. mobile data terminals) in City of Santa Fe police vehicles.	Existing
City of Santa Fe Public Works Department	City of Santa Fe Accident Database Users	Users of the accident archive data management system for the City of Santa Fe.	Planned
City of Santa Fe Public Works Department	City of Santa Fe CCTV	Closed circuit television owned by the City of Santa Fe.	Existing
City of Santa Fe Public Works Department	City of Santa Fe CV RSE	Connected Vehicle Roadside Equipment for City of Santa Fe	Planned
City of Santa Fe Public Works Department	City of Santa Fe DMS	Fixed or portable dynamic message signs owned and operated by City of Santa Fe.	Planned
City of Santa Fe Public Works Department	City of Santa Fe Equipment Repair Facility	The equipment repair facility for the City of Santa Fe where signal systems, or other types of ITS field equipment, are repaired.	Existing
City of Santa Fe Public Works Department	City of Santa Fe Field Sensors	Field sensors such as vehicle detectors (e.g. loops and VIVDS)	Existing
City of Santa Fe Public Works Department	City of Santa Fe Maintenance and Construction Vehicles	Maintenance and construction vehicles for the City of Santa Fe.	Existing
City of Santa Fe Public Works Department	City of Santa Fe Public Works Public Information Office	The office provides the official interface between the City of Santa Fe's Public Works and the City's traffic department and outside interests such as the media.	Planned
City of Santa Fe Public Works Department	City of Santa Fe RWIS systems	Road weather information systems operated by City of Santa Fe	Planned
City of Santa Fe Public Works Department	City of Santa Fe School Pager System	The school pager system operated by the City of Santa Fe.	Existing

Stakeholder	Element Name	Element Description	Status
City of Santa Fe Public Works Department	City of Santa Fe Storage Yard	Storage yard owned and operated by the City of Santa Fe	Existing
City of Santa Fe Public Works Department	City of Santa Fe Streets and Drainage Maintenance Division	Dispatch function for city of Santa Fe Streets, Drainage, and Fleet. Includes asset management functions for the Division.	Existing
City of Santa Fe Public Works Department	City of Santa Fe Traffic Operations Section	The traffic operations division for the City of Santa Fe. The system includes closed loop signal controls and CCTV.	Existing
City of Santa Fe Public Works Department	City of Santa Fe Traffic Signal Shop	The maintenance shop for all roadside equipment owned and operated by the City of Santa Fe.	Existing
City of Santa Fe Public Works Department	City of Santa Fe Traffic Signals	Traffic signal systems operated by City of Santa Fe.	Existing
City of Santa Fe Public Works Department	City of Santa Fe Work Zone Equipment	Work zone equipment (such as portable DMS) operated by the City of Santa Fe.	Existing
City of Santa Fe Public Works Department	Santa Fe Municipal Airport	Regional airport in the Santa Fe region.	Existing
City of Santa Fe Senior Services	City of Santa Fe Senior Services Demand Response Dispatch	The demand response transit dispatch center for the City of Santa Fe's Senior Services.	Existing
City of Santa Fe Senior Services	City of Santa Fe Senior Services Vehicles	The demand response transit vehicles operated by the City of Santa Fe Senior Services. Includes the ITS field equipment installed on each vehicle.	Planned
City/County of Santa Fe	Municipal or County Permitting System	Every city has a CVO HAZMAT, OS/OW permitting process.	Existing
City/County of Santa Fe	Santa Fe City/County EOC	The joint Emergency Operations Center for the City and County of Santa Fe.	Existing
Commercial Vehicle Operators	Private Fleet Management Systems	Includes private commercial fleet management operations in the region.	Planned
Correctional Facilities	Correctional Facilities Operations	Operations centers for regional correctional facilities. Includes county and state correctional facilities.	Existing
County Emergency Management Agencies	Other County EOC	Emergency Operations Centers of other counties located outside the region.	Existing

Stakeholder	Element Name	Element Description	Status
Department of Game and Fish	Department of Game and Fish Vehicles	Vehicles operated by the Department of Game and Fish.	Existing
Electric Charging Station Operators	Electric Vehicle Charging Stations	Charging Stations for Electric Vehicles	Planned
Financial Institution	Financial Institution	Represents the financial institutions the regional transit agencies will use as part of electronic fare payment systems. Includes Health Services through NMDOT.	Existing
Independent School Districts	Independent School District Buses	The buses owned and operated by the various independent school districts. ITS equipment installed on district buses may include AVL, MDTs and security monitoring equipment (CCTV, silent alarms, etc..)	Existing
Independent School Districts	Independent School District Dispatch	Dispatch function for each of the Independent School Districts throughout the region. Includes radio communication with school buses.	Existing
Local Media	Local Print and Broadcast Media	Local TV (including cable TV), radio, and newspapers.	Existing
Local Transit Operators	Santa Fe Region Intermodal Transit Terminal	Intermodal transit terminal planned for the Santa Fe area.	Planned
New Mexico Department of Public Safety - DPS	New Mexico Statewide Emergency Operations Center (EOC)	The statewide emergency operations center located in Albuquerque.	Existing
New Mexico Department of Public Safety - DPS	NMDOT Crash Database Users	Users systems for accessing the Statewide Crash Record Information System	Existing
New Mexico Department of Public Safety - DPS	State Office of Emergency Management	The statewide office of emergency management where information on emergencies, disasters, or incidents come from and go to.	Existing
New Mexico Department of Public Safety - DPS	State Police District 1 Administration	Highway Patrol function in the region that collects crash information for forwarding to statewide system.	Existing
New Mexico Department of Public Safety - DPS	State Police District 1 Dispatch	Dispatches State Police Vehicles using two-way radio communication. Responsible for regional evacuation.	Existing

Stakeholder	Element Name	Element Description	Status
New Mexico Department of Public Safety - DPS	State Police Vehicles	State Police vehicles that provide public safety services on state owned roads and highways. Represents the ITS equipment installed in state police vehicles (MDTs, Cameras, etc.).	Existing
New Mexico General Services Department	Santa Fe Control	State communications dispatch for EM, MC, Forest Service, EMS, and hospitals.	Existing
NMDOT - New Mexico Department of Transportation	ITA System	Alert system for the state of New Mexico.	Existing
NMDOT - New Mexico Department of Transportation	New Mexico Park and Ride	Dispatch function of Northern New Mexico Park and Ride. Dispatches both Demand-Response and Fixed Route vehicles.	Existing
NMDOT - New Mexico Department of Transportation	New Mexico Park and Ride Vehicles	Fixed route transit vehicles operated by Northern New Mexico Park and Ride.	Existing
NMDOT - New Mexico Department of Transportation	New Mexico Park and Ride Website	The website run by the Northern New Mexico Park and Ride (currently only contains static scheduling information).	Existing
NMDOT - New Mexico Department of Transportation	NMDOT Central Permit Office	The central permit office for NMDOT. Coordinates permits with other states and acts as a data repository for regional permits.	Existing
NMDOT - New Mexico Department of Transportation	NMDOT Crash Database	Statewide database of vehicle crash records. Input to system provided by elements in the region.	Existing
NMDOT - New Mexico Department of Transportation	NMDOT CV RSE	Connected Vehicle Roadside Equipment for NMDOT	Planned
NMDOT - New Mexico Department of Transportation	NMDOT District 5 Automated Gates	Automatic gate closure equipment. Currently manual, but should be electronic in the future.	Planned

Stakeholder	Element Name	Element Description	Status
NMDOT - New Mexico Department of Transportation	NMDOT District 5 CCTV	Closed Circuit Television devices that are operated and maintained by NMDOT.	Existing
NMDOT - New Mexico Department of Transportation	NMDOT District 5 DMS	Dynamic Message Signs operated and maintained by NMDOT. Includes: portable DMS, permanent DMS, and speed warning signs.	Planned
NMDOT - New Mexico Department of Transportation	NMDOT District 5 Field Sensors	Traffic vehicle sensors, including VIVDS or microwave vehicle detection, owned by NMDOT.	Existing
NMDOT - New Mexico Department of Transportation	NMDOT District 5 Maintenance and Construction Vehicles	The maintenance vehicles that are dispatch by NMDOT maintenance.	Existing
NMDOT - New Mexico Department of Transportation	NMDOT District 5 Maintenance Dispatch	NMDOT maintenance sections for District 5. Dispatches maintenance vehicles and equipment for maintaining road and ITS equipment owned by NMDOT.	Existing
NMDOT - New Mexico Department of Transportation	NMDOT District 5 Pavement Management System	District Pavement Management System to assist in storing, retrieving, analyzing and reporting information to help with pavement-related decision-making processes.	Existing
NMDOT - New Mexico Department of Transportation	NMDOT District 5 Public Information Office	The office provides the official interface between NMDOT traffic and maintenance departments and interests outside the departments such as the media.	Planned
NMDOT - New Mexico Department of Transportation	NMDOT District 5 Public Transportation Management System (PTMS)	Maintains a Transit Vehicle Inventory for public transit vehicles that receive federal and state funds. Also, able to generate ridership information such as cost per mile, revenues per mile, total revenues, etc.	Existing
NMDOT - New Mexico Department of Transportation	NMDOT District 5 Roadway Service Patrols	Motorist service patrols that are dispatched to stranded vehicles or persons located on the NMDOT highways, roads, or other.	Planned

Stakeholder	Element Name	Element Description	Status
NMDOT - New Mexico Department of Transportation	NMDOT District 5 RWIS	Road weather information systems (RWIS) owned and operated by the Santa Fe district.	Planned
NMDOT - New Mexico Department of Transportation	NMDOT District 5 Security Equipment	Security equipment owned and operated by the NMDOT Santa Fe district office.	Planned
NMDOT - New Mexico Department of Transportation	NMDOT District 5 Shop	This facility provides repair and maintenance services for NMDOT maintenance vehicles and equipment (e.g. portable DMS).	Existing
NMDOT - New Mexico Department of Transportation	NMDOT District 5 TOC	The traffic operations center for NMDOT. The TOC will manage traffic on freeways and state owned arterials.	Planned
NMDOT - New Mexico Department of Transportation	NMDOT District 5 Traffic Signals	This includes lane control, ramp metering and traffic signals owned by NMDOT.	Existing
NMDOT - New Mexico Department of Transportation	NMDOT District 5 Work Zone Equipment	Work zone monitoring and alerting equipment owned by NMDOT.	Planned
NMDOT - New Mexico Department of Transportation	NMDOT Highway Maintenance Management System	The maintenance archive management system for NMDOT. Specifically, this system aids NMDOT in determining appropriate maintenance activities as well as archiving various maintenance activities (for date, location, type of activity, labor, equipment used, materials used, etc.).	Existing
NMDOT - New Mexico Department of Transportation	NMDOT ITS Bureau	New Mexico Department of Transportation ITS Bureau responsible for managing ITS inventory.	Existing
NMDOT - New Mexico Department of Transportation	NMDOT ITS Database	Database of ITS assets owned by NMDOT. Also includes service patrol dispatch archives.	Existing

Stakeholder	Element Name	Element Description	Status
NMDOT - New Mexico Department of Transportation	NMDOT ITS Database Users	Systems and agencies that make use of NMDOT ITS Database information.	Existing
NMDOT - New Mexico Department of Transportation	NMDOT Patrol Yard	Storage facility used by the New Mexico Department of Transportation.	Existing
NMDOT - New Mexico Department of Transportation	NMDOT Signal Lab	NMDOT facility for providing maintenance on NMDOT traffic signal systems.	Existing
NMDOT - New Mexico Department of Transportation	NMDOT Statewide TMC	NMDOT Transportation Management Center located in Albuquerque. Currently controls the ITS field equipment for District 3. In the future may have the ability to control other District field equipment (but primarily serves as a backup system or operates when the District TOCs are offline - after hours).	Existing
NMDOT - New Mexico Department of Transportation	NMDOT TIMS	The NMDOT Transportation Information Management System (TIMS) manages transportation infrastructure, inventory, attributes, and assets in a geospatial context. It is the core system used to report to FHWA.	Existing
NMDOT - New Mexico Department of Transportation	NMDOT Traffic Count Collection Section	Department of NMDOT that is responsible for traffic count collection.	Existing
NMDOT - New Mexico Department of Transportation	NMDOT Traffic Signal Shop	The traffic signal repair facility for the NMDOT Santa Fe District.	Existing
NMDOT - New Mexico Department of Transportation	NMDOT Transit and Rail Division	The NMDOT Transit and Rail Division plan to archive transit and rail data within the state.	Planned
NMDOT - New Mexico Department of Transportation	NMDOT Traveler Information Display/ Kiosks	Traveler information displays or kiosks planned for rail stations, park and ride lots, or rest areas.	Planned

Stakeholder	Element Name	Element Description	Status
NMDOT - New Mexico Department of Transportation	NMRoads	The Conditions Acquisition Reporting System (CARS) provides a multi-state database of travel events such as accidents and roadwork. CARS software allows authorized staff to input construction, accident, delay, and other roadway, weather and tourism event information into statewide databases. The CARS server also supports routine DOT dispatch, press release and emergency response activities.	Existing
NMDOT - New Mexico Department of Transportation	Other NMDOT District Maintenance Dispatch	NMDOT Maintenance dispatch function in neighboring districts.	Existing
NMDOT - New Mexico Department of Transportation	Other NMDOT District TMCs	Transportation Management Centers in other New Mexico regions (e.g. District 4 and 6).	Existing
NOAA	National Weather Service	National service for national, regional, and local weather information.	Existing
North Central Regional Transit District	North Central Regional Transit Dispatch	Fixed route and paratransit dispatch functions. North Central Regional offers specialized door thru door transportation for the disabled who qualify under the Americans with Disabilities Act of 1990. It also operates fixed routes in the city of Espanola.	Planned
North Central Regional Transit District	North Central Regional Transit Vehicles	Fixed route and demand response transit vehicles operated by the North Central Regional Transit	Planned
North Central Regional Transit District	North Central Regional Transit Website	Transit and Paratransit schedule and fare information. In the future, tied into AVL for real time schedules.	Planned
Operation Respond Institute	Operation Respond	Operation Respond provides hazmat information.	Existing
Other Counties	Other County Public Safety Dispatch and PSAP	Dispatch centers for police, fire, EMS, and PSAP at the county level in the counties adjoining the region.	Existing
Private Concierge Service Providers	Private Concierge Service Providers	Private concierge service providers within the Santa Fe region. Includes Onstar, etc. May transmit operational data for road network condition determination and traffic count information.	Existing

Stakeholder	Element Name	Element Description	Status
Private Consultants	Project Private Consultants	Private consultants on highway projects who collect traffic count data as part of their development activities.	Planned
Private Equipment Repair Providers	County Equipment Repair Facility	Equipment repair facilities operated at the county level.	Existing
Private Parking Payment Services	Private Parking Payment Services	Mobile payments for on street parking in the City of Santa Fe	Planned
Private Sector Traveler Information Service Providers	Private Sector Traveler Information Services	Private traveler information providers serving the region. This element could, in the future, provide support to the National Traveler Information 511 number since it collects information from a broad array of operating centers. Could also include websites of local media.	Planned
Private Taxi Providers	Private Taxi Provider Dispatch	Dispatch function for private taxi providers. Includes SECA, a non-profit van pool org. for state employees.	Existing
Private Tow/Wrecker Providers	Private Tow/Wrecker Dispatch	Dispatch function for privately owned tow or wrecker service. Based on a rotation list.	Planned
Private Traffic Data Providers	Private Traffic Data Collection Equipment	Traffic equipment operated by third party data providers. Includes probe data, such as bluetooth.	Planned
Private Traffic Data Providers	Private Traffic Data Service	Private service that collects traffic data, such as from bluetooth readers.	Planned
Private Transportation Providers	Intercity Bus Company Dispatch	Fixed route transit dispatch functions for intercity buses.	Existing
Private Travelers	Private Travelers Personal Computing Devices	Includes personal and office computers, pagers, and handheld devices used by travelers to receive ITS information.	Existing
Private Travelers	Private Vehicles	Vehicles owned by private individuals in the area.	Existing
Private Weather Service Providers	Private Weather Service	Companies that provide transportation focused weather information.	Existing
Private/Public Ambulance Providers	Private/Public Ambulance Dispatch	Dispatch functions for private ambulance companies in the region.	Existing
Private/Public Ambulance Providers	Private/Public Ambulance Vehicle	The vehicles dispatched by private ambulance companies.	Existing

Stakeholder	Element Name	Element Description	Status
Rail Operators	Rail Operations Centers	The dispatch centers for major railroads in the region (e.g. Santa Fe Southern).	Existing
Rail Operators	Rail Operators Wayside Equipment	The rail operated equipment at highway rail intersections. Interconnect with the region's traffic control departments.	Existing
RECC Stakeholders	Regional Emergency Communications Center (RECC)	An independent emergency 911 center serving both the city and the county public safety agencies. The center began operations in July 2002	Existing
Regional Medical Center	Regional Medical Centers	Medical centers that are located within the Santa Fe region (hospitals) or within the adjacent regions (Albuquerque, NM).	Existing
Regional Public Safety Agencies	Regional Emergency Communications Network	Regional public safety communications network.	Planned
Rio Metro	Rail Runner Express Operations	Operations center for the commuter rail line that is planned to run from Belen to Albuquerque to Santa Fe.	Planned
Rio Metro	Rail Runner Express Vehicles	Rail vehicles of the commuter rail line.	Planned
Santa Fe Convention and Visitors Bureau	Santa Fe Convention and Visitors Bureau	Municipal Convention and Visitors Bureau has information on upcoming events in the region.	Existing
Santa Fe County Public Safety Agencies	Santa Fe County Public Safety Administration	The administration function of county sheriffs, which collect crash records of their jurisdiction and provide them to the state.	Existing
Santa Fe County Public Safety Agencies	Santa Fe County Public Safety Vehicles	Public safety vehicles (sheriff, fire, and EMS) operated by Santa Fe County.	Existing
Santa Fe County Public Works	Santa Fe County CV RSE	Connected Vehicle Roadside Equipment for Santa Fe County	Planned
Santa Fe County Public Works	Santa Fe County Field Equipment	The field equipment owned and operated by the County Road and Bridge agency for maintenance and other activities. Includes portable dynamic message signs.	Existing
Santa Fe County Public Works	Santa Fe County Maintenance Dispatch	Public works. Maintenance of roads and bridges in Santa Fe County.	Existing

Stakeholder	Element Name	Element Description	Status
Santa Fe County Public Works	Santa Fe County Maintenance Vehicles	The maintenance vehicles that are dispatch by Santa Fe County.	Existing
Santa Fe County Public Works	Santa Fe County Public Information Office	The office provides the official interface between Santa Fe County and traffic and maintenance departments as well as interests outside these departments such as the media.	Existing
Santa Fe County Public Works	Santa Fe County Storage Yard	Storage yard owned and operated by Santa Fe County.	Existing
Santa Fe County Public Works	Santa Fe County Traffic Count Section	The traffic count division of Santee Fe County who is responsible for collecting all traffic sensor and flow information from the County's ITS field devices.	Existing
Santa Fe County Public Works	Santa Fe County Traffic Operations Center	The Traffic Operations Center operated by Santa Fe County.	Existing
Santa Fe County Public Works	Santa Fe County Website	Website for Santa Fe County that could be used in the future to provide traffic or maintenance information.	Existing
Santa Fe MPO	Santa Fe MPO Archive	Archive management system for the Metropolitan Planning Organization for the City of Santa Fe. Potentially includes traffic counts.	Existing
Santa Fe MPO	Santa Fe MPO Archive Users	Users of the City of Santa Fe MPO's archive data system.	Existing
Santa Fe MPO	Santa Fe MPO Field Devices	Field devices owned and operated by the Santa Fe MPO - generally for traffic counts.	Existing
Santa Fe Trails	Santa Fe Ride Dispatch	The demand response and paratransit dispatch center for Santa Fe Trails.	Existing
Santa Fe Trails	Santa Fe Ride Transit Vehicles	Demand response and paratransit vehicles for Santa Fe Trails. Includes the ITS elements installed on the demand response and paratransit vehicles.	Existing
Santa Fe Trails	Santa Fe Trails Call Center	Call Center for Santa Fe Trails fixed Route Operations.	Existing
Santa Fe Trails	Santa Fe Trails Data Archive	Archived data system for Santa Fe Trails	Existing
Santa Fe Trails	Santa Fe Trails Fixed Route Dispatch	Fixed route dispatch function of Santa Fe Trails.	Existing

Stakeholder	Element Name	Element Description	Status
Santa Fe Trails	Santa Fe Trails Fixed Route Transit Vehicles	Fixed Route transit vehicles for Santa Fe Trails. Includes the ITS elements installed on the fixed route transit vehicles.	Existing
Santa Fe Trails	Santa Fe Trails Website	Transit website for Santa Fe Trails which shows static schedule information for Santa Fe Trails fixed route vehicles. Future applications will include a means to request demand response or paratransit vehicle service through the website.	Existing
Santa Fe Trails	Transit Fare Card	Planned smart card for use on Santa Fe Trails transit.	Planned
Town of Taos	Taos Express Dispatch	This element represents the dispatch function of the Taos Express Shuttle.	Existing
Transit Partnership	Transit Center Equipment	This element represents equipment such as bus arrival signs and kiosks installed at one of the transit or multimodal centers including- Downtown Transit Center (Sheridan Street), Santa Fe Place Transit Center, Santa Fe Depot, and South Capital Station.	Planned
Tribal Councils	Tribal Emergency Dispatch	The dispatch function of tribal police.	Existing
Volunteer Fire Departments	Volunteer Fire Departments	Volunteer fire departments dispatched by the County Sheriff's office.	Existing

5.2. Systems by Physical Object

Each element in the regional architecture inventory is mapped to one or more physical objects from ARC-IT. In version 8.2 of ARC-IT (on which this architecture is based) there are 139 physical objects defined. These 42 subsystems and 97 terminators describe a wide array of systems that provide ITS services, or interface with systems that provide ITS services. The mapping of regional ITS architecture elements to ARC-IT physical objects has two primary benefits. First it allows the full set of information flows contained in ARC-IT to be used in the description of regional ITS architecture interfaces, and second, it allows the elements of the regional architecture to be grouped by like physical object. Table 5 provides just such a sorting of inventory elements by physical object. This table allows the users of the architecture to immediately identify all the elements that have functions relating to transit management, or traffic management.

The Santa Fe Regional ITS Architecture inventory contains the following number of elements mapped to different types of entities:

- Data Management: 12
- Emergency Management Centers: 23
- Traveler Information Centers: 14
- Maintenance and Construction Management Center: 10
- Traffic Management Center: 8
- Transit Management Center: 12

Table 5: Inventory Sorted by Physical Object

Physical Objects	Element Name	Stakeholder	Status
Alerting and Advisory System	ITA System	NMDOT - New Mexico Department of Transportation	Existing
Alternate Mode Transportation Center	Santa Fe Municipal Airport	City of Santa Fe Public Works Department	Existing
Alternate Mode Transportation Center	Santa Fe Region Intermodal Transit Terminal	Local Transit Operators	Planned
Archived Data System	City of Santa Fe Accident Database	City of Santa Fe Police Department	Existing
Archived Data System	City of Santa Fe Traffic Counts Program	City of Santa Fe	Existing
Archived Data System	NMDOT Crash Database	NMDOT - New Mexico Department of Transportation	Existing
Archived Data System	NMDOT District 5 Public Transportation Management System (PTMS)	NMDOT - New Mexico Department of Transportation	Existing

Physical Objects	Element Name	Stakeholder	Status
Archived Data System	NMDOT Highway Maintenance Management System	NMDOT - New Mexico Department of Transportation	Existing
Archived Data System	NMDOT ITS Database	NMDOT - New Mexico Department of Transportation	Existing
Archived Data System	NMDOT TIMS	NMDOT - New Mexico Department of Transportation	Existing
Archived Data System	NMDOT Traffic Count Collection Section	NMDOT - New Mexico Department of Transportation	Existing
Archived Data System	NMDOT Transit and Rail Division	NMDOT - New Mexico Department of Transportation	Planned
Archived Data System	Project Private Consultants	Private Consultants	Planned
Archived Data System	Santa Fe County Traffic Count Section	Santa Fe County Public Works	Existing
Archived Data System	Santa Fe MPO Archive	Santa Fe MPO	Existing
Archived Data System	Santa Fe Trails Data Archive	Santa Fe Trails	Existing
Archived Data User System	City of Santa Fe Accident Database Users	City of Santa Fe Public Works Department	Planned
Archived Data User System	NMDOT Crash Database Users	New Mexico Department of Public Safety - DPS	Existing
Archived Data User System	NMDOT ITS Database Users	NMDOT - New Mexico Department of Transportation	Existing
Archived Data User System	Santa Fe MPO Archive Users	Santa Fe MPO	Existing
Asset Management System	NMDOT District 5 Pavement Management System	NMDOT - New Mexico Department of Transportation	Existing
Care Facility	Regional Medical Centers	Regional Medical Center	Existing
Commercial Vehicle Administration Center	Municipal or County Permitting System	City/County of Santa Fe	Existing
Commercial Vehicle Administration Center	NMDOT Central Permit Office	NMDOT - New Mexico Department of Transportation	Existing
Connected Vehicle Roadside Equipment	City of Santa Fe CV RSE	City of Santa Fe Public Works Department	Planned
Connected Vehicle Roadside Equipment	NMDOT CV RSE	NMDOT - New Mexico Department of Transportation	Planned

Physical Objects	Element Name	Stakeholder	Status
Connected Vehicle Roadside Equipment	NMDOT District 5 Field Sensors	NMDOT - New Mexico Department of Transportation	Existing
Connected Vehicle Roadside Equipment	NMDOT District 5 Work Zone Equipment	NMDOT - New Mexico Department of Transportation	Planned
Connected Vehicle Roadside Equipment	Private Traffic Data Collection Equipment	Private Traffic Data Providers	Planned
Connected Vehicle Roadside Equipment	Santa Fe County CV RSE	Santa Fe County Public Works	Planned
Electric Charging Station	Electric Vehicle Charging Stations	Electric Charging Station Operators	Planned
Emergency Management Center	Bureau of Indian Affairs Dispatch	Bureau of Indian Affairs	Existing
Emergency Management Center	Correctional Facilities Operations	Correctional Facilities	Existing
Emergency Management Center	Independent School District Dispatch	Independent School Districts	Existing
Emergency Management Center	New Mexico Park and Ride	NMDOT - New Mexico Department of Transportation	Existing
Emergency Management Center	New Mexico Statewide Emergency Operations Center (EOC)	New Mexico Department of Public Safety - DPS	Existing
Emergency Management Center	NMDOT District 5 TOC	NMDOT - New Mexico Department of Transportation	Planned
Emergency Management Center	North Central Regional Transit Dispatch	North Central Regional Transit District	Planned
Emergency Management Center	Operation Respond	Operation Respond Institute	Existing
Emergency Management Center	Other County EOC	County Emergency Management Agencies	Existing
Emergency Management Center	Other County Public Safety Dispatch and PSAP	Other Counties	Existing
Emergency Management Center	Private Tow/Wrecker Dispatch	Private Tow/Wrecker Providers	Planned
Emergency Management Center	Private/Public Ambulance Dispatch	Private/Public Ambulance Providers	Existing
Emergency Management Center	Regional Emergency Communications Center (RECC)	RECC Stakeholders	Existing
Emergency Management Center	Santa Fe City/County EOC	City/County of Santa Fe	Existing

Physical Objects	Element Name	Stakeholder	Status
Emergency Management Center	Santa Fe Control	New Mexico General Services Department	Existing
Emergency Management Center	Santa Fe County Public Safety Administration	Santa Fe County Public Safety Agencies	Existing
Emergency Management Center	Santa Fe Ride Dispatch	Santa Fe Trails	Existing
Emergency Management Center	Santa Fe Trails Fixed Route Dispatch	Santa Fe Trails	Existing
Emergency Management Center	State Office of Emergency Management	New Mexico Department of Public Safety - DPS	Existing
Emergency Management Center	State Police District 1 Administration	New Mexico Department of Public Safety - DPS	Existing
Emergency Management Center	State Police District 1 Dispatch	New Mexico Department of Public Safety - DPS	Existing
Emergency Management Center	Tribal Emergency Dispatch	Tribal Councils	Existing
Emergency Management Center	Volunteer Fire Departments	Volunteer Fire Departments	Existing
Emergency Vehicle OBE	City of Santa Fe Fire/EMS Vehicles	City of Santa Fe Fire Department	Existing
Emergency Vehicle OBE	City of Santa Fe Police Vehicles	City of Santa Fe Police Department	Existing
Emergency Vehicle OBE	Department of Game and Fish Vehicles	Department of Game and Fish	Existing
Emergency Vehicle OBE	NMDOT District 5 Roadway Service Patrols	NMDOT - New Mexico Department of Transportation	Planned
Emergency Vehicle OBE	Private/Public Ambulance Vehicle	Private/Public Ambulance Providers	Existing
Emergency Vehicle OBE	Santa Fe County Public Safety Vehicles	Santa Fe County Public Safety Agencies	Existing
Emergency Vehicle OBE	State Police Vehicles	New Mexico Department of Public Safety - DPS	Existing
Enforcement Center	City of Santa Fe Enforcement Section	City of Santa Fe	Existing
Equipment Repair Facility	City of Santa Fe Equipment Repair Facility	City of Santa Fe Public Works Department	Existing
Equipment Repair Facility	City of Santa Fe Traffic Signal Shop	City of Santa Fe Public Works Department	Existing

Physical Objects	Element Name	Stakeholder	Status
Equipment Repair Facility	County Equipment Repair Facility	Private Equipment Repair Providers	Existing
Equipment Repair Facility	NMDOT District 5 Shop	NMDOT - New Mexico Department of Transportation	Existing
Equipment Repair Facility	NMDOT Traffic Signal Shop	NMDOT - New Mexico Department of Transportation	Existing
Event Promoter System	Santa Fe Convention and Visitors Bureau	Santa Fe Convention and Visitors Bureau	Existing
Financial Center	Financial Institution	Financial Institution	Existing
Fleet and Freight Management Center	Private Fleet Management Systems	Commercial Vehicle Operators	Planned
Fleet and Freight Management Center	Rail Operations Centers	Rail Operators	Existing
ITS Roadway Equipment	City of Santa Fe CCTV	City of Santa Fe Public Works Department	Existing
ITS Roadway Equipment	City of Santa Fe DMS	City of Santa Fe Public Works Department	Planned
ITS Roadway Equipment	City of Santa Fe Field Sensors	City of Santa Fe Public Works Department	Existing
ITS Roadway Equipment	City of Santa Fe On-Street Parking Meters	City of Santa Fe	Existing
ITS Roadway Equipment	City of Santa Fe RWIS systems	City of Santa Fe Public Works Department	Planned
ITS Roadway Equipment	City of Santa Fe School Pager System	City of Santa Fe Public Works Department	Existing
ITS Roadway Equipment	City of Santa Fe Traffic Signals	City of Santa Fe Public Works Department	Existing
ITS Roadway Equipment	City of Santa Fe Work Zone Equipment	City of Santa Fe Public Works Department	Existing
ITS Roadway Equipment	NMDOT District 5 Automated Gates	NMDOT - New Mexico Department of Transportation	Planned
ITS Roadway Equipment	NMDOT District 5 CCTV	NMDOT - New Mexico Department of Transportation	Existing
ITS Roadway Equipment	NMDOT District 5 DMS	NMDOT - New Mexico Department of Transportation	Planned
ITS Roadway Equipment	NMDOT District 5 Field Sensors	NMDOT - New Mexico Department of Transportation	Existing
ITS Roadway Equipment	NMDOT District 5 RWIS	NMDOT - New Mexico Department of Transportation	Planned
ITS Roadway Equipment	NMDOT District 5 Traffic Signals	NMDOT - New Mexico Department of Transportation	Existing

Physical Objects	Element Name	Stakeholder	Status
ITS Roadway Equipment	NMDOT District 5 Work Zone Equipment	NMDOT - New Mexico Department of Transportation	Planned
ITS Roadway Equipment	Private Traffic Data Collection Equipment	Private Traffic Data Providers	Planned
ITS Roadway Equipment	Santa Fe County Field Equipment	Santa Fe County Public Works	Existing
ITS Roadway Equipment	Santa Fe MPO Field Devices	Santa Fe MPO	Existing
Maint and Constr Management Center	City of Santa Fe Streets and Drainage Maintenance Division	City of Santa Fe Public Works Department	Existing
Maint and Constr Management Center	City of Santa Fe Traffic Operations Section	City of Santa Fe Public Works Department	Existing
Maint and Constr Management Center	City of Santa Fe Traffic Signal Shop	City of Santa Fe Public Works Department	Existing
Maint and Constr Management Center	NMDOT District 5 Maintenance Dispatch	NMDOT - New Mexico Department of Transportation	Existing
Maint and Constr Management Center	NMDOT ITS Bureau	NMDOT - New Mexico Department of Transportation	Existing
Maint and Constr Management Center	NMDOT Signal Lab	NMDOT - New Mexico Department of Transportation	Existing
Maint and Constr Management Center	NMDOT Statewide TMC	NMDOT - New Mexico Department of Transportation	Existing
Maint and Constr Management Center	NMRoads	NMDOT - New Mexico Department of Transportation	Existing
Maint and Constr Management Center	Other NMDOT District Maintenance Dispatch	NMDOT - New Mexico Department of Transportation	Existing
Maint and Constr Management Center	Santa Fe County Maintenance Dispatch	Santa Fe County Public Works	Existing
Maint and Constr Vehicle OBE	City of Santa Fe Collection Section	City of Santa Fe	Planned
Maint and Constr Vehicle OBE	City of Santa Fe Maintenance and Construction Vehicles	City of Santa Fe Public Works Department	Existing
Maint and Constr Vehicle OBE	NMDOT District 5 Maintenance and Construction Vehicles	NMDOT - New Mexico Department of Transportation	Existing
Maint and Constr Vehicle OBE	Santa Fe County Maintenance Vehicles	Santa Fe County Public Works	Existing
Media	Local Print and Broadcast Media	Local Media	Existing

Physical Objects	Element Name	Stakeholder	Status
Other Emergency Management Centers	Regional Emergency Communications Network	Regional Public Safety Agencies	Planned
Other Maint and Constr Mgmt Centers	City of Santa Fe Streets and Drainage Maintenance Division	City of Santa Fe Public Works Department	Existing
Other Maint and Constr Mgmt Centers	NMDOT District 5 Maintenance Dispatch	NMDOT - New Mexico Department of Transportation	Existing
Other Maint and Constr Mgmt Centers	Other NMDOT District Maintenance Dispatch	NMDOT - New Mexico Department of Transportation	Existing
Other Maint and Constr Mgmt Centers	Santa Fe County Maintenance Dispatch	Santa Fe County Public Works	Existing
Parking Management System	City of Santa Fe Parking Division Operations	City of Santa Fe	Existing
Parking Management System	City of Santa Fe Parking Garages	City of Santa Fe	Existing
Payment Administration Center	City of Santa Fe Parking Division Operations	City of Santa Fe	Existing
Payment Administration Center	Private Parking Payment Services	Private Parking Payment Services	Planned
Payment Device	Parking Smart Card	City of Santa Fe	Planned
Payment Device	Transit Fare Card	Santa Fe Trails	Planned
Personal Information Device	Private Travelers Personal Computing Devices	Private Travelers	Existing
Rail Operations Center	Rail Operations Centers	Rail Operators	Existing
Security Monitoring Equipment	NMDOT District 5 Security Equipment	NMDOT - New Mexico Department of Transportation	Planned
Storage Facility Data Acquisition System	City of Santa Fe Storage Yard	City of Santa Fe Public Works Department	Existing
Storage Facility Data Acquisition System	NMDOT Patrol Yard	NMDOT - New Mexico Department of Transportation	Existing
Storage Facility Data Acquisition System	Santa Fe County Storage Yard	Santa Fe County Public Works	Existing
Traffic Management Center	City of Santa Fe Traffic Operations Section	City of Santa Fe Public Works Department	Existing
Traffic Management Center	NMDOT District 5 TOC	NMDOT - New Mexico Department of Transportation	Planned
Traffic Management Center	NMDOT ITS Bureau	NMDOT - New Mexico Department of Transportation	Existing

Physical Objects	Element Name	Stakeholder	Status
Traffic Management Center	NMDOT Signal Lab	NMDOT - New Mexico Department of Transportation	Existing
Traffic Management Center	NMDOT Statewide TMC	NMDOT - New Mexico Department of Transportation	Existing
Traffic Management Center	Other NMDOT District TMCs	NMDOT - New Mexico Department of Transportation	Existing
Traffic Management Center	Private Traffic Data Service	Private Traffic Data Providers	Planned
Traffic Management Center	Santa Fe County Traffic Operations Center	Santa Fe County Public Works	Existing
Transit Management Center	Albuquerque Transit Dispatch	Albuquerque Transit	Existing
Transit Management Center	City of Santa Fe Senior Services Demand Response Dispatch	City of Santa Fe Senior Services	Existing
Transit Management Center	Independent School District Dispatch	Independent School Districts	Existing
Transit Management Center	Intercity Bus Company Dispatch	Private Transportation Providers	Existing
Transit Management Center	New Mexico Park and Ride	NMDOT - New Mexico Department of Transportation	Existing
Transit Management Center	North Central Regional Transit Dispatch	North Central Regional Transit District	Planned
Transit Management Center	Private Taxi Provider Dispatch	Private Taxi Providers	Existing
Transit Management Center	Rail Runner Express Operations	Rio Metro	Planned
Transit Management Center	Santa Fe Pickup Dispatch	City of Santa Fe	Planned
Transit Management Center	Santa Fe Ride Dispatch	Santa Fe Trails	Existing
Transit Management Center	Santa Fe Trails Fixed Route Dispatch	Santa Fe Trails	Existing
Transit Management Center	Taos Express Dispatch	Town of Taos	Existing
Transit Vehicle OBE	City of Santa Fe Senior Services Vehicles	City of Santa Fe Senior Services	Planned
Transit Vehicle OBE	Independent School District Buses	Independent School Districts	Existing
Transit Vehicle OBE	New Mexico Park and Ride Vehicles	NMDOT - New Mexico Department of Transportation	Existing

Physical Objects	Element Name	Stakeholder	Status
Transit Vehicle OBE	North Central Regional Transit Vehicles	North Central Regional Transit District	Planned
Transit Vehicle OBE	Rail Runner Express Vehicles	Rio Metro	Planned
Transit Vehicle OBE	Santa Fe Pickup Vehicles	City of Santa Fe	Planned
Transit Vehicle OBE	Santa Fe Ride Transit Vehicles	Santa Fe Trails	Existing
Transit Vehicle OBE	Santa Fe Trails Fixed Route Transit Vehicles	Santa Fe Trails	Existing
Transportation Information Center	City of Santa Fe Public Information Office	City of Santa Fe	Existing
Transportation Information Center	City of Santa Fe Public Works Public Information Office	City of Santa Fe Public Works Department	Planned
Transportation Information Center	City of Santa Fe Website	City of Santa Fe	Existing
Transportation Information Center	New Mexico Park and Ride Website	NMDOT - New Mexico Department of Transportation	Existing
Transportation Information Center	NMDOT Crash Database	NMDOT - New Mexico Department of Transportation	Existing
Transportation Information Center	NMDOT District 5 Public Information Office	NMDOT - New Mexico Department of Transportation	Planned
Transportation Information Center	NMRoads	NMDOT - New Mexico Department of Transportation	Existing
Transportation Information Center	North Central Regional Transit Website	North Central Regional Transit District	Planned
Transportation Information Center	Private Sector Traveler Information Services	Private Sector Traveler Information Service Providers	Planned
Transportation Information Center	Private Traffic Data Service	Private Traffic Data Providers	Planned
Transportation Information Center	Santa Fe County Public Information Office	Santa Fe County Public Works	Existing
Transportation Information Center	Santa Fe County Website	Santa Fe County Public Works	Existing
Transportation Information Center	Santa Fe Trails Call Center	Santa Fe Trails	Existing
Transportation Information Center	Santa Fe Trails Website	Santa Fe Trails	Existing

Physical Objects	Element Name	Stakeholder	Status
Travel Services Provider System	Private Concierge Service Providers	Private Concierge Service Providers	Existing
Traveler Card	Parking Smart Card	City of Santa Fe	Planned
Traveler Card	Transit Fare Card	Santa Fe Trails	Planned
Traveler Support Equipment	NMDOT Traveler Information Display/ Kiosks	NMDOT - New Mexico Department of Transportation	Planned
Traveler Support Equipment	Transit Center Equipment	Transit Partnership	Planned
Vehicle OBE	Private Vehicles	Private Travelers	Existing
Wayside Equipment	Rail Operators Wayside Equipment	Rail Operators	Existing
Weather Service System	National Weather Service	NOAA	Existing
Weather Service System	Private Weather Service	Private Weather Service Providers	Existing

6. Services

The ITS systems in the region currently provide a wide array of transportation services and that list will grow as more systems are developed or upgraded. The services can be described by the set of service packages that are shown in Table 6. This table provides for each service package the status (existing or planned) of the service package. Where the service is currently provided by some of the elements (but not others) there is a mix of existing and planned status within a single service package. A service is considered to be existing if some interfaces to provide the service are currently provided via electronic communications.

Table 6: Regional Service Packages

Service Package	Service Package Name	Status
CVO04	CV Administrative Processes	Planned
CVO12	HAZMAT Management	Planned
DM01	ITS Data Warehouse	Planned
MC01	Maintenance and Construction Vehicle and Equipment Tracking	Planned
MC02	Maintenance and Construction Vehicle Maintenance	Planned
MC04	Winter Maintenance	Planned
MC05	Roadway Maintenance and Construction	Planned
MC06	Work Zone Management	Planned
MC07	Work Zone Safety Monitoring	Planned
MC08	Maintenance and Construction Activity Coordination	Planned
PM01	Parking Space Management	Planned
PM03	Parking Electronic Payment	Planned
PM04	Regional Parking Management	Planned
PS01	Emergency Call-Taking and Dispatch	Existing
PS02	Routing Support for Emergency Responders	Planned
PS03	Emergency Vehicle Preemption	Existing
PS06	Incident Scene Pre-Arrival Staging Guidance for Emergency Responders	Planned
PS08	Roadway Service Patrols	Planned
PS09	Transportation Infrastructure Protection	Planned
PS10	Wide-Area Alert	Planned
PS12	Disaster Response and Recovery	Planned

PS13	Evacuation and Reentry Management	Planned
PS14	Disaster Traveler Information	Planned
PT01	Transit Vehicle Tracking	Existing
PT02	Transit Fixed-Route Operations	Existing
PT03	Dynamic Transit Operations	Existing
PT04	Transit Fare Collection Management	Planned
PT05	Transit Security	Planned
PT06	Transit Fleet Management	Planned
PT07	PT07-01	Planned
PT07	Transit Passenger Counting	Planned
PT08	Transit Traveler Information	Existing
PT09	Transit Signal Priority	Planned
PT14	Multi-modal Coordination	Planned
PT16	Route ID for the Visually Impaired	Planned
ST05	Electric Charging Stations Management	Planned
TI01	Broadcast Traveler Information	Existing
TI02	Personalized Traveler Information	Planned
TM01	Infrastructure-Based Traffic Surveillance	Existing
TM02	Vehicle-Based Traffic Surveillance	Planned
TM03	Traffic Signal Control	Existing
TM04	Connected Vehicle Traffic Signal System	Planned
TM05	Traffic Metering	Planned
TM06	Traffic Information Dissemination	Existing
TM07	Regional Traffic Management	Planned
TM08	Traffic Incident Management System	Planned
TM13	Standard Railroad Grade Crossing	Planned
TM16	Wrong Way Vehicle Detection	Planned
TM19	Roadway Closure Management	Planned
TM21	Speed Harmonization	Planned
VS12	Pedestrian and Cyclist Safety	Planned
WX01	Weather Data Collection	Planned
WX02	Weather Information Processing and Distribution	Planned
WX03	Spot Weather Impact Warning	Planned

7. Interfaces and Information Exchanges

7.1. Customized Service Packages

The service packages of ARC-IT were customized to reflect the unique systems and connections of the region. Each service package is shown graphically, with the service package name, the entity from ARC-IT, and the specific Santa Fe elements associated with the entity. In addition, the service packages show the information flows that move between elements.

Figure 4 is an example of a Traffic Management service package for Traffic Signal Control that has been customized for the Santa Fe Region.

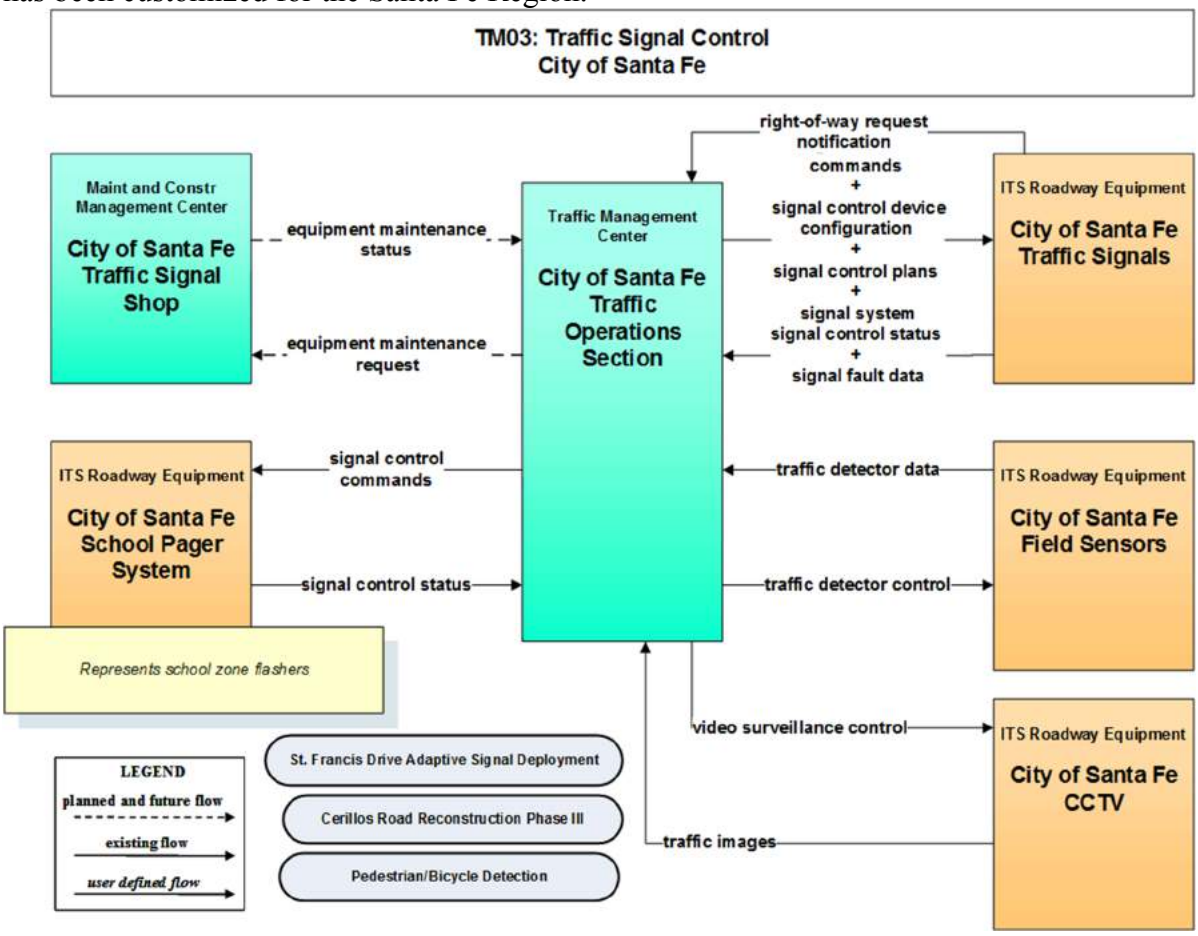


Figure 4: Example Customized Service Package

This service package shows three physical objects, Maintenance and Construction Management Center, Traffic Management Center and ITS Roadway Equipment, and the associated elements. Information flows between the physical objects indicate what information is being shared. The service packages that were customized for the Santa Fe Regional ITS Architecture can be found on the architecture website by selecting the "Services" button at the top. Service packages are grouped by stakeholder and by functional areas (e.g. Traffic Management, Maintenance and Construction, and Public Transportation) and each set of customized service packages can be

viewed by clicking on the Service Package Diagram icon under each area heading. On the website, only those service packages selected for the region are shown on the lists and included in the diagrams.

7.2. Regional Architecture Information Flows

While it is important to identify the various systems and stakeholders as part of a regional ITS architecture, a primary purpose of the architecture is to identify the *connectivity* between transportation systems in the region. The customized service packages represent services that can be deployed as an integrated capability, and the customized service package diagrams show the information flows between the subsystems and terminators that are most important to the operation of the service packages. How these systems interface with each other is an integral part of the overall architecture.

There are 147 different elements identified as part of the Santa Fe Regional ITS Architecture. These elements include municipal, county, and state traffic operations centers, transit centers, transit vehicles, public safety dispatch centers, media outlets, and others—essentially all of the existing and planned physical components that contribute to the region's intelligent transportation system. Interfaces have been defined for each element in the architecture. For example, the City of Santa Fe Traffic Operations Section has planned interfaces with 30 other elements in the region ranging from field equipment to transit centers. Some of the interfaces are far less complex. For example, the City of Santa Fe Field Sensors has interfaces with only two other elements in the architecture. In total the architecture defines 417 interfaces from one element to another.

Elements and their interfaces are accessible via the Santa Fe Regional ITS Architecture web page by clicking on the "Inventory" button, then the "Inventory by Stakeholder" button. On the web page, elements are listed alphabetically in the column on the right (sorted by stakeholder- the column on the left). By clicking on (selecting) an element, the element detail page comes up where the user can view the element definition, the current status of the element, who the stakeholder is, and the other elements with which the selected element interfaces. Figure 5 below is an example of part of the element detail page for the Santa Fe Trails Fixed Route Dispatch. By clicking on (selecting) an interfacing element, more detailed information about the particular interface is pulled up.

Santa Fe Regional ITS Architecture (Draft)

Home | Stakeholders | Inventory | Services | Interfaces | Projects | Resources

ELEMENT DETAIL

Feedback

Element Name:	Santa Fe Trails Fixed Route Dispatch
Description:	Fixed route dispatch function of Santa Fe Trails.
Status:	Existing
Stakeholder:	Santa Fe Trails
Element Interfaces: (Linked to Interface Flows) 	City of Santa Fe Public Works Public Information Office City of Santa Fe Streets and Drainage Maintenance Division City of Santa Fe Traffic Operations Section Financial Institution New Mexico Park and Ride NMDOT District 5 Maintenance Dispatch NMDOT District 5 Public Information Office NMDOT District 5 Public Transportation Management System (PTMS) NMDOT Transit and Rail Division NMRoads North Central Regional Transit Dispatch Private Sector Traveler Information Services Rail Runner Express Operations Regional Emergency Communications Center (RECC) Santa Fe City/County EOC Santa Fe County Maintenance Dispatch Santa Fe Municipal Airport Santa Fe Pickup Dispatch Santa Fe Region Intermodal Transit Terminal Santa Fe Ride Dispatch Santa Fe Trails Call Center Santa Fe Trails Fixed Route Transit Vehicles Santa Fe Trails Website Taos Express Dispatch Transit Center Equipment
Service Packages:	DM01: ITS Data Warehouse DM01-01: NMDOT PTMS MC08: Maintenance and Construction Activity Coordination MC08-03: Activity Coordination - NMDOT (3 of 3) MC08: Maintenance and Construction Activity Coordination MC08-05: City of Santa Fe Public Works (2 of 2) PS13: Evacuation and Reentry Management PS13-01: City/County EOC PT01: Transit Vehicle Tracking PT01-01: Santa Fe Trails PT02: Transit Fixed-Route Operations PT02-01: Santa Fe Trails

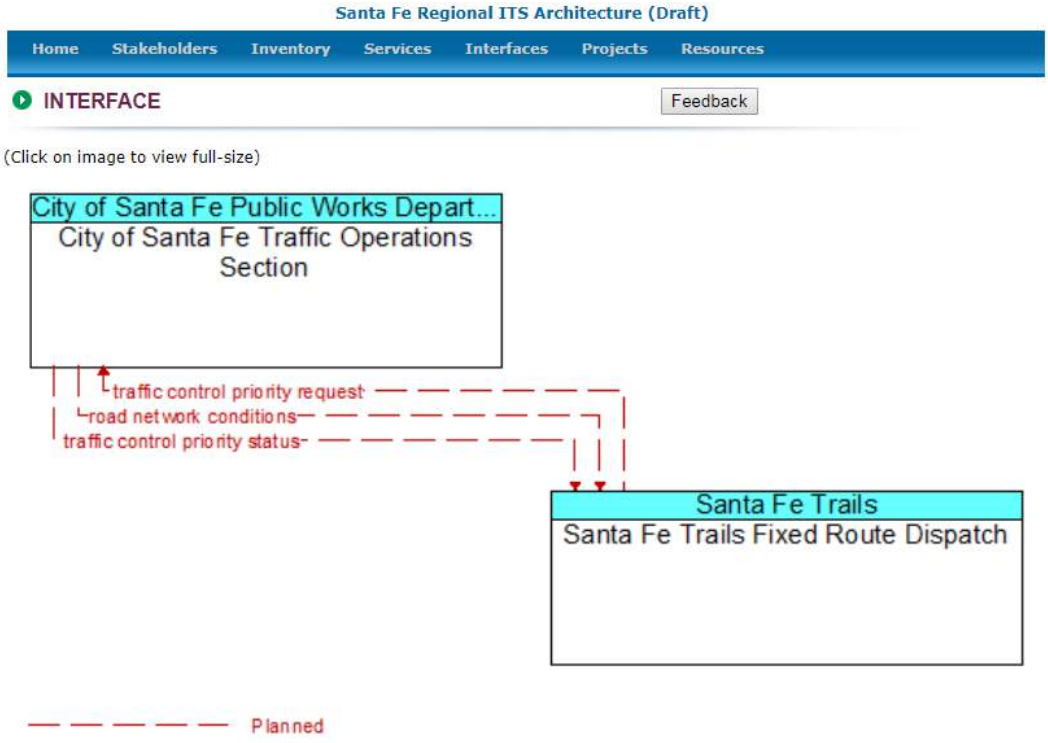
Figure 5: Example of Element Detail Showing Interfaces

Information flows between the elements define specific information that is exchanged by the elements. Each information flow has a direction, name and definition. Most of the architecture flows match ones from ARC-IT (the mapping of elements to ARC-IT physical objects allowed the developers to match the flows to the appropriate interfaces). In some cases new user defined flows have been created for interfaces or connectivities that are not expressed in ARC-ITARC-IT (Note these flows have a "_ud" at the end of the name to indicate they are user defined.). These information flows define the interface requirements between the various elements in the regional

architecture. Considering a source element, architecture flow, destination element triplet, the Santa Fe Regional ITS Architecture defines 1365 of these triplets.

An example of the information flows between two elements is shown in Figure 6. In this interface the flows that go between the City of Santa Fe Traffic Section and the Santa Fe Trails Fixed Route Dispatch are shown. Although both of these elements exist, they do not currently have an electronic connection, so all the flows on this interface are shown as planned.

Each of the individual element interfaces can be accessed on the Santa Fe Regional ITS Architecture web pages from the element details pages. For example, selecting the interface between the Santa Fe Trails Fixed Route Dispatch and the City of Santa Fe Traffic Operations Section from the element detail page shown in Figure 5 will provide a diagram of the interface and a listing of the information flows between the elements (as shown in Figure 6). Selecting any of the interface architecture flows will provide a definition, and any standards associated with that architecture flow are noted.



(E) = Existing Flow
(P) = Planned/Future Flow
(E/P) = Existing and Planned Flow - Flow appears as Existing and Planned

Source	Information Flows	Destination
City of Santa Fe Traffic Operations Section	traffic control priority status (P) road network conditions (P)	Santa Fe Trails Fixed Route Dispatch
Santa Fe Trails Fixed Route Dispatch	traffic control priority request (P)	City of Santa Fe Traffic Operations Section

Figure 6: Example of Information Flows Between Elements

8. Functional Requirements

Functional requirements are a description of the functions or activities that are currently performed by the ITS elements or that are planned to be performed in the future. For the Santa Fe Regional ITS Architecture, these functions have been developed by using the functional assignments underlying ARC-IT and the mapping from elements to physical objects shown in Table 5.

In ARC-IT, a Service Package is defined by subsystems, functional objects, and information flows, which operate together to perform a particular transportation service (see Section 3 above). Functional objects represent pieces of a subsystem that perform a single function. (NOTE: there are no functional objects defined for the Terminators of ARC-IT since they represent systems on the boundary of the architecture and, therefore, do not have functional descriptions within the architecture.) For example, the Traffic Signal Control (TM03) service package is composed of the three Traffic Management Center functional objects, TMC Basic Surveillance, TMC Signal Control and TMC Roadway Equipment Monitoring, and three ITS Roadway Equipment Roadway Subsystem functional objects, Roadway Field Management Station Operation, Roadway Basic Surveillance, and Roadway Signal Control. The definitions of these functional functional objects, copied from version 8.2 of ARC-IT, are:

- TMC Basic Surveillance – "TMC Basic Surveillance" remotely monitors and controls traffic sensors and surveillance (e.g., CCTV) equipment, and collects, processes and stores the collected traffic data. Current traffic information and other real-time transportation information is also collected from other centers. The collected information is provided to traffic operations personnel and made available to other centers.

- TMC Signal Control – 'TMC Signal Control' provides the capability for traffic managers to monitor and manage the traffic flow at signalized intersections. This capability includes analyzing and reducing the collected data from traffic surveillance equipment and developing and implementing control plans for signalized intersections. Control plans may be developed and implemented that coordinate signals at many intersections under the domain of a single traffic management subsystem and are responsive to traffic conditions and adapt to support incidents, preemption and priority requests, pedestrian crossing calls, etc.

- TMC Roadway Equipment Monitoring – 'TMC Roadway Equipment Monitoring' monitors the operational status of field equipment and detects failures. It presents field equipment status to Traffic Operations Personnel and reports failures to the Maintenance and Construction Management Center. It tracks the repair or replacement of the failed equipment. The entire range of ITS field equipment may be monitored including sensors (traffic, infrastructure, environmental, security, speed, etc.) and devices (highway

advisory radio, dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, beacons, security surveillance equipment, etc.).

- Roadway Field Management Station Operation - 'Roadway Field Management Station Operation' supports direct communications between field management stations and the local field equipment under their control.
- Roadway Basic Surveillance -- 'Roadway Basic Surveillance' monitors traffic conditions using fixed equipment such as loop detectors and CCTV cameras.
- Roadway Signal Controls – 'Roadway Signal Control' includes the field elements that monitor and control signalized intersections. It includes the traffic signal controllers, detectors, conflict monitors, signal heads, and other ancillary equipment that supports traffic signal control. It also includes field masters, and equipment that supports communications with a central monitoring and/or control system, as applicable. The communications link supports upload and download of signal timings and other parameters and reporting of current intersection status. It represents the field equipment used in all levels of traffic signal control from basic actuated systems that operate on fixed timing plans through adaptive systems. It also supports all signalized intersection configurations, including those that accommodate pedestrians. In advanced, future implementations, environmental data may be monitored and used to support dilemma zone processing and other aspects of signal control that are sensitive to local environmental conditions.

The approach used in the Santa Fe regional ITS Architecture was to begin with the mapping of functional objects to elements (based on the mapping of elements to service packages within the architecture) as an initial definition of the functions being performed by each element. Then this mapping is tailored, or customized, in the RAD-IT tool to provide a more accurate picture of the functions performed by each element. The RAD-IT tool also contains a detailed mapping of functional requirements (written as “shall” statements) to each functional object. The current version of RAD-IT does not allow customization of the detailed functional requirements, so as viewed on the website (see below), all the requirements for each functional object are shown.
The mapping of elements to the basic functions (functional objects) is provided on the hyperlinked web site version of the architecture. The detail page for each element (which is accessed by clicking on the hyperlinked element name within the “ITS Inventory”, “Inventory by Stakeholder” or “Inventory by Entity” tabs) has a list of the functional objects assigned to the element. Sometimes the user may need to scroll down to see the functional objects.
For example, the City of Santa Fe Traffic Operations Section element has the following functional objects assigned to it:

- TMC Advanced Rail Crossing Management
- TMC Basic Surveillance

- TMC Data Collection
- TMC Environmental Monitoring
- TMC Evacuation Support
- TMC Incident Detection
- TMC Incident Dispatch Coordination
- TMC Intersection Safety
- TMC Multi-Modal Coordination
- TMC Passive Surveillance
- TMC Regional Traffic Management
- TMC Roadway Equipment Monitoring
- TMC Signal Control
- TMC Situation Data Management
- TMC Standard Rail Crossing Management
- TMC Traffic Information Dissemination
- TMC Work Zone Traffic Management

This represents a first level of detail that can be obtained in the hyperlinked web site in connection with functionality. The additional level of detail, or detailed functional requirements, can be accessed by clicking on any of the functional objects associated with the element you have under review. Using the above example, viewing the City of Santa Fe Traffic Operations Section element detail page the user can see the functional objects listed above. If the user were to select one of the functional objects (all listed as hyperlinks), the functional object detail page would appear. It lists the detailed functional requirements that have been customized for the Santa Fe Regional ITS Architecture.

9. Standards

The following subsections provide a discussion of ITS standards potentially applicable in the state and how to identify the standards that might be applicable on a specific interface within the architecture.

9.1. Discussion of Key Standards for the Region

ITS standards establish a common way in which devices connect and communicate with one another. This allows transportation agencies to implement systems that cost-effectively exchange pertinent data and accommodate equipment replacement, system upgrades, and system expansion. Standards benefit the traveling public by providing products that will function consistently and reliably throughout the region. ITS standards contribute to a safer and more efficient transportation system, facilitate regional interoperability, and promote an innovative and competitive service for transportation products and services.

The use of ITS standards is very important to project development in the Santa Fe region. Table 7 identifies the ITS standards that are potentially applicable to the state. This table was created by taking the standards information available in the RAD-IT database (which identifies standards applicable to each information flow) and taking the total set of standards that result from all of the selected flows. The table provides the status of the standards effort as of June 2019 (the most recent update of the information). The table lists the abbreviation of Standards Development Organization (SDO) in the first column, the name of the standard in the second column and the number of the standard in the third column. Regular updates of SDO activities will help ensure that the latest standards are utilized. The SDOs involved in the development of ITS standards who are listed in the table include:

- American Association of State Highway and Transportation Officials (AASHTO)
- American National Standards Institute (ANSI)
- American Public Transportation Association (APTA)
- American Society for Testing and Materials (ASTM)
- Institute of Electrical and Electronics Engineers (IEEE)
- Institute of Transportation Engineers (ITE)
- National Equipment Manufacturers Association (NEMA)
- Society of Automotive Engineers (SAE)

Table 7: Applicable ITS Standards

SDO	Document ID	Standard Title	Standard Type
ANSO	ANSI TS813	Electronic Filing of Tax Return Data	Message/Data
APTA	APTA TCIP-S-001 5.0.1	Standard for Transit Communications Interface Profiles	Message/Data

SDO	Document ID	Standard Title	Standard Type
ASTM	ASTM E2468-05	Standard Practice for Metadata to Support Archived Data Management Systems	Message/Data
ASTM	ASTM E2665-08	Standard Specifications for Archiving ITS-Generated Traffic Monitoring Data	Message/Data
Consortium of AASHTO, ITE, and NEMA	NTCIP 1201	Global Object Definitions	Message/Data
Consortium of AASHTO, ITE, and NEMA	NTCIP 1202	Object Definitions for Actuated Traffic Signal Controller (ASC) Units	Message/Data
Consortium of AASHTO, ITE, and NEMA	NTCIP 1203	Object Definitions for Dynamic Message Signs (DMS)	Message/Data
Consortium of AASHTO, ITE, and NEMA	NTCIP 1204	Object Definitions for Environmental Sensor Stations (ESS)	Message/Data
Consortium of AASHTO, ITE, and NEMA	NTCIP 1205	Object Definitions for Closed Circuit Television (CCTV) Camera Control	Message/Data
Consortium of AASHTO, ITE, and NEMA	NTCIP 1206	Object Definitions for Data Collection and Monitoring (DCM) Devices	Message/Data
Consortium of AASHTO, ITE, and NEMA	NTCIP 1207	Object Definitions for Ramp Meter Control (RMC) Units	Message/Data
Consortium of AASHTO, ITE, and NEMA	NTCIP 1208	Object Definitions for Closed Circuit Television (CCTV) Switching	Message/Data
Consortium of AASHTO, ITE, and NEMA	NTCIP 1209	Data Element Definitions for Transportation Sensor Systems (TSS)	Message/Data
Consortium of AASHTO, ITE, and NEMA	NTCIP 1210	Field Management Stations (FMS) - Part 1: Object Definitions for Signal System Masters	Message/Data
Consortium of AASHTO, ITE, and NEMA	NTCIP 1211	Object Definitions for Signal Control and Prioritization (SCP)	Message/Data
Consortium of AASHTO, ITE, and NEMA	NTCIP 1213	Object Definitions for Electrical and Lighting Management Systems (ELMS)	Message/Data
European Committee for Standardization	TS 15531	Service Interface for Real-Time Information (SIRI)	Message/Data

SDO	Document ID	Standard Title	Standard Type
General Transit Feed Specification Discussion Group	GTFS	General Transit Feed Specification (GTFS) Static	Message/Data
IEEE	IEEE 1512 -2006	Standard for Common Incident Management Message Sets for use by Emergency Management Centers	Message/Data
IEEE	IEEE 1512.3-2006	Standard for Hazardous Material Incident Management Message Sets for Use by Emergency Management Centers	Message/Data
IEEE	IEEE 1570-2002	Standard for the Interface Between the Rail Subsystem and the Highway Subsystem at a Highway Rail Intersection	Message/Data
IEEE	ITE TMDD	Traffic Management Data Dictionary (TMDD) and Message Sets for External Traffic Management Center Communications (MS/ETMCC)	Message/Data
Profile	Contact-Proximity-Interface	Proximity Communication Interface	Standard Profile
Profile	DSRC-UDP	Vehicle-to-Vehicle/Infrastructure using UDP	Standard Profile
Profile	DSRC-WSMP	Vehicle-to-Vehicle/Infrastructure using WSMP	Standard Profile
Profile	NTCIP-DATEX	NTCIP using DATEX	Standard Profile
Profile	NTCIP-SMTP	NTCIP using SMTP	Standard Profile
Profile	NTCIP-SNMP	NTCIP using SNMP	Standard Profile
Profile	RSE-C2F	RSE - Center to Field Communications	Standard Profile
Profile	RSE-C2F-SNMP	RSE - Center to Field Communications - SNMP	Standard Profile
Profile	RSE-F2F	Roadside Equipment to ITS Roadway Equipment	Standard Profile
Profile	RSEGateway-VehicleDestination	Vehicle Communications via RSEs, Vehicle Destination	Standard Profile

SDO	Document ID	Standard Title	Standard Type
Profile	RSEGateway-VehicleSource	Vehicle Communications via RSEs, Vehicle Source	Standard Profile
Profile	SRC-Legacy	Legacy Short Range Comm Using IEEE 1455	Standard Profile
Profile	VehicleGateway-CenterSource	Vehicle Cluster from Center	Standard Profile
Profile	WAB-Via-WAID	Wide-Area-Broadcast-Via-WAID	Standard Profile
Profile	WAW-ASN1	Wide Area Wireless using ASN.1 as encoding method	Standard Profile
Profile	WAW-WWWBrowser-JSON	Wide Area Wireless using JSON as encoding method	Standard Profile
Profile	WAW-XML	Wide Area Wireless using XML as encoding method	Standard Profile
Profile	XML	eXtensible Markup Language	Standard Profile
SAE	J2945/1	On-Board System Requirements for V2V Safety Communications	Communications Protocol
SAE	SAE J2354	Message Set for Advanced Traveler Information System (ATIS)	Message/Data
SAE	SAE J2735	Dedicated Short Range Communications (DSRC) Message Set Dictionary	Message/Data
SAE	SAE J3067	Candidate Improvements to Dedicated Short Range Communications (DSRC) Message Set Dictionary [SAE J2735] Using Systems Engineering Methods	Message/Data

The communications profiles identified in the table above define the protocols necessary to define how information is transferred between physical objects. This includes a complete definition of the SubNet and TransNet Layers, any necessary Facilities Layer protocols (e.g. W3C HTTP), and any necessary Security Plane (e.g. IETF TLS) standards used by these layers. A data profile defines the necessary ITS information and the high-level rules for exchanging this information with a peer physical object, but does not define how the information is transferred. This includes definitions of data elements, messages, dialogs and message sequencing. This view of communications profiles was first introduced in ARC-IT V8.0. The details of each profile can be found on the ARC-IT website at:
https://local.iteris.com/arc-it/html/comm/profiles.html.

9.2. Reference to the Detailed Standards information on the Web Site

The previous section provides a general discussion of the standards environment in the state. However, the architecture does contain a far more detailed standards view, one that maps applicable standards to the individual information flows that goes from one element to another. This detailed information is contained in the hyperlinked web site and can be accessed through the links to the information flows shown as part of each interface. Each element description page has a set of links that describe the information flowing to and from the element to other elements of the architecture. Selecting any of these interface links brings the user an interface page. For example, the interface between the NMDOT Statewide TMC and the NMDOT DMS (dynamic message signs) is shown in Figure 8. There are two information flows going to the DMS element and two coming back from it. Selecting one of the flows provides information regarding the flow and gives a list of ITS standards that are applicable to the flow. An example, for the roadway information system data flow, is shown in Figure 7.

(E) = Existing Flow
(P) = Planned/Future Flow
(E/P) = Existing and Planned Flow - Flow appears as Existing and Planned

Source	Information Flows	Destination
NMDOT DMS	roadway warning system status (E) roadway dynamic signage status (E)	NMDOT Statewide TMC
NMDOT Statewide TMC	roadway warning system control (E) roadway dynamic signage data (E)	NMDOT DMS

Figure 7: Example of Interface Details

Flow Overview	
Flow Name:	roadway dynamic signage data
Description:	Information used to initialize, configure, and control dynamic message signs. This flow can provide message content and delivery attributes, local message store maintenance requests, control mode commands, status queries, and all other commands and associated parameters that support remote management of these systems.

Flow Standards	
Std Name	**Std Title**
ASTM E2468-05-Metadata	Standard Practice for Metadata to Support Archived Data Management Systems
NTCIP 1203-DMS	Object Definitions for Dynamic Message Signs (DMS)
NTCIP 1204-ESS	Object Definitions for Environmental Sensor Stations (ESS)

Figure 8: Example of standards mapping page

10. Project Sequencing

The incorporation of the ITS architecture in the planning process will ultimately yield projects that are linked to the ITS Architecture. Through the deployment of projects produced from the planning process, the services supported in the ITS Architecture will be implemented and made a reality in the transportation system. Project implementation completes the evolution from transportation needs to services, to functional descriptions in the ITS Architecture, to project identification in the planning process, and to project definition and deployment. The overarching goal of the ITS Architecture development process is that this evolution takes place with the maximum amount of integration knowledge possible so as to efficiently and economically implement the systems required to serve the transportation community and users.

Key to this process or evolution is to understand what dependencies or relationships exist between systems and projects so that an order can be identified for deployment. Given the importance of integration of ITS, the dependencies of one system on another or one project on another, it is critical to view the entire transportation system at a high, functional level. The ITS Architecture provides this view point and makes possible the understanding of the relationships between the ITS systems in the region.

Project sequencing defines the order in which ITS projects should be implemented. A good sequence is based on a combination of transportation planning factors that are used to prioritize projects and the project dependencies that show how successive ITS projects can build on one another. In most cases, the first projects in the project sequence will already be programmed and will simply be extracted from existing transportation plans. Successive projects will then be added to the sequence based on the project dependencies and other planning factors.

Key stakeholders provided inputs regarding planned ITS related projects.. The projects were then organized and are provided in Table 8. The information included in each of the projects is:

- **Project Name and Location**. The name of the proposed ITS project.
- **Description**. The description of the project or services to be provided.
- **Key Stakeholders**. The primary agencies responsible for the implementation of the project.
- **Service Packages**. Maps the proposed ITS project to a transportation service identified in the Santa Fe Regional ITS Architecture and reflects traceability.
- **Timeframe**. Indicates the estimated timeframe for an ITS project to be deployed. It is estimated that short-term projects will be implemented in 0-5 years; medium-term projects will be implemented in 5-10 years; and long-term projects will be implemented in over 10 years.

Table 8: Project List

Project Name	Description	Stakeholder	Service Package	Timeframe
Avenida Del Sur Extension	Construction of a new road and upgrade of existing roadway from NM14 to Avenida Del Sur	Santa Fe County Public Works	TM01-03	Medium
			TM03-04	
Cerillos Road Reconstruction Phase III	Improvements to Cerrillos Road from St. Michaels Dr to St. Francis Dr..	City of Santa Fe Public Works Department	TM01-01	Short
			TM03-01	
Connected Vehicle Applications for Traffic Signals	Potential deployment of connected vehicle applications at traffic signals in the City of Santa Fe and Santa Fe County	City of Santa Fe Public Works Department	TM04-01	Long
		NMDOT - New Mexico Department of Transportation	TM04-02	
		Santa Fe County Public Works	TM04-03	
Flood Warning Sensors	Sensors to warn of flooding on roadways which are prone to flooding	Santa Fe County Public Works	WX03-01	Medium
Guadalupe Interchange Improvement	Interchange into US 84/285 from downtown. Includes any ITS, not currently defined. May add a camera.	NMDOT - New Mexico Department of Transportation	TM01-02	Medium
Mobile Data Terminals for Santa Fe County Fire/Sheriff	Mobile data terminals including AVL.	Santa Fe County Public Safety Agencies	PS02-03	Short
		RECC Stakeholders	TM08-13	
NMDOT CCTV at Opera Hill Road	Deploy CCTV on US 84/285 at Opera Hill Road.	NMDOT - New Mexico Department of Transportation	TM01-01	Short
NMDOT District 5 Traffic Operations Center	Development of District 5 TOC.	NMDOT - New Mexico Department of Transportation	TM03-03	Medium
			TM01-02	
			TM03-03	
			TM05-01	
			TM06-02	

Project Name	Description	Stakeholder	Service Package	Timeframe
			TM07-01	
			TM07-02	
			TM08-02	
NMDOT Park and Ride Information Displays	Traveler Info displays at park and ride facilities	NMDOT - New Mexico Department of Transportation	PT02-02	Medium
			PT08-04	
NMDOT Road Weather Information Systems (RWIS)	Various RWIS stations throughout the region. Could include an RWIS on I-25 at La Bajada hill.	NMDOT - New Mexico Department of Transportation	WX01-01	Short
NMDOT Service Patrol	For I-25 and State Roads. Important on Pojoaque corridor.	NMDOT - New Mexico Department of Transportation	PS08-01	Medium
NMDOT Wrong Way Vehicle Detection	Develop wrong way vehicle detection systems at on/off ramps for I-25.	NMDOT - New Mexico Department of Transportation	TM16-01	Medium
Pedestrian/Bicycle Detection	Detection and warning of bicyclists and pedestrians. Incorporate data from Strava.	City of Santa Fe Public Works Department	TM03-01	Medium
		NMDOT - New Mexico Department of Transportation	TM03-03	
		Santa Fe County Public Works	TM03-04	
Police Vehicle Wireless Video	Add to Police Vehicles, add capability to share with DOTs	City of Santa Fe Police Department	TM08-14	Medium
		RECC Stakeholders	TM08-14	
RECC CAD Upgrade	MDT operations, MDT browser. Push more data to vehicles. Incorporate cameras?	City of Santa Fe Fire Department	PS01-02	Short
		City of Santa Fe Police Department	PS02-01	
		RECC Stakeholders	PS02-02	

Project Name	Description	Stakeholder	Service Package	Timeframe
		Santa Fe County Public Safety Agencies	PS02-03	
Regional Electric Vehicle Charging Network	Unified sharing of electric vehicle charging station information	Santa Fe County Public Works	ST05-01	Medium
Renovations to the Sheridan Street Transit Center	Design and Construction of Multimodal facility. Includes electronic signage.	Santa Fe Trails	PT08-02	Short
		Transit Partnership		
Santa Fe Bicycle Detection	This project will deploy bicycle detection systems at signalized intersections.	City of Santa Fe Public Works Department	VS12-01	Medium
Santa Fe CCTV Deployment	Deploy additional CCTV devices in the City of Santa Fe	City of Santa Fe Public Works Department	TM01-01	Medium
Santa Fe DMS for Parking	DMS signs to provide information on parking availability	City of Santa Fe Public Works Department	PM04-01	Medium
Santa Fe RWIS Deployment	Deploy RWIS devices on city roads.	City of Santa Fe Public Works Department	WX01-02	Long
Santa Fe Trails Boarding and Alighting Counting	Connect fareboxes to Routematch systems to get determination of boardings and alightings	Santa Fe Trails	PT04-01	Short
			PT07-01	
Santa Fe Trails Farebox Upgrades	Replace Fareboxes	Santa Fe Trails	PT04-01	Short
Santa Fe Trails Fixed Route AVL	Incorporation of AVL systems on Fixed Route buses	Santa Fe Trails	PT01-01	Short
Santa Fe Trails Next Bus System	Allow for the dissemination of bus locations via Kiosks at Transit hubs, website and or real time telephone calls.	Santa Fe Trails	PT01-01	Short
		Transit Partnership	PT08-01	
			PT08-02	
Santa Fe Trails On-Board Video	Expand capability to send real-time video to the center	Santa Fe Trails	PT05-01	Medium
Santa Fe Trails Stop Annunciation	Automatic stop annunciation on-board vehicles	Santa Fe Trails	PT16-01	Medium
Santa Fe Trails System Interconnection	Expand the interconnection with regional transit systems	Santa Fe Trails	PT14-01	Medium
		Santa Fe Trails	PT02-01	Medium

Project Name	Description	Stakeholder	Service Package	Timeframe
Santa Fe Trails Transit Center Electronic Signage	Deploy electronic signage at downtown or southside centers		PT08-02	
St. Francis Drive Adaptive Signal Deployment	Deploy adaptive signal systems on St. Francis Drive, either north or south of Cerrillos. The signal system upgrades would be funded by NMDOT.	City of Santa Fe Public Works Department	TM03-01	Medium
Upgrades to St. Francis and St. Michaels Intersection	Reconstruct intersection. Add fibreoptic lines, DMS. Upgrade traffic signals, CCTV.	NMDOT - New Mexico Department of Transportation	TM01-02 TM03-02 TM03-03 TM06-02	Medium

As displayed in Table 8, projects are classified as short/medium/long-term timeframes. These projects should be represented in the Santa Fe Metropolitan Transportation Plan (MTP) (and in fact several of the projects are drawn from the current MTP). As these sequenced projects go through the planning process, the ones identified as short-term would be transitioned in the TIP and Capital Plan/Budget. Since the table defines a short-term project as being deployed in 0-5 years and the TIP and Capital Plan/Budget defines a project as being deployed in 1-3 years, stakeholders are required to further examine the short-term projects and determine which should be represented in the TIP and Capital Plan/Budget.

The key question stakeholders may ask is, "Now that we have a comprehensive list of ITS projects separated by timeframes, how do I use the projects? To answer this question, stakeholders should focus on the following concepts:

- **Why is this Important**. Stakeholders should remember the reasons for going through the process of creating sequenced ITS projects. Ultimately, they want to deploy projects that support the needs expressed in their ITS Architecture.
- **Who's in Charge**. Stakeholders should consider identifying a person or group that is responsible for managing how ITS Projects get deployed. This person or group would be aware of the big picture by familiarizing themselves with all of the planned activities and ensure integration opportunities are maximized in project deployments.
- **Systematic Process**. Stakeholders should ensure that projects are managed in a systematic manner.
- **Project List Management**. Stakeholders should prioritize projects within their common timeframes based on the aforementioned concepts. It is important for short-term projects to be reviewed by stakeholders prior to being transitioned into the TIP. A person or group designated as a list manager should be responsible for removing projects from the regional list once implemented. Although project lists may reflect a single project, projects are typically broken into multiple phases and are implemented in an incremental manner. For example, many ITS projects are partially deployed as part of larger construction projects. A project's scope might involve interfacing with ten agencies and funding constraints may require agencies to be interconnected one at a time. In this situation, a project might by implemented in five years, if two agencies are being interconnected per year. If a project is partially implemented due to unforeseen circumstances (e.g. limited funding received), then the list manager should update the project to reflect the remaining components that need to be implemented. The key point for project list management is projects will be implemented in an incremental manner, therefore the list manager should keep accurate records of the incremental process and meet with stakeholders to determine how funding should be reallocated.
- **Desired Outcome**. Stakeholders should remember the desired outcome which is to deploy projects to maximize integration opportunities throughout the state. Therefore, when projects are transitioned into the project development phase, stakeholders should always be aware of other project deployment activities (even if the other activities require a project to be deployed at a different time). This mindset will require stakeholders to be

flexible in developing interfaces what will allow for future expansion based on overall regional needs.

An important issue to remember is when a project it to be implemented, stakeholders should convene to determine the specific details for deploying a project (e.g. how many phases will be required for this project and which components of service packages are allocated to a particular phase?). Table 8 can be used as a guide to which agencies/systems and interfaces should be considered during the discussion and design phase for project implementation.

11. Agreements

There are several types of arrangements associated with the interfaces included with the projects discussed previously. Data exchanges between systems require agreements on the transmission protocol and data formats to ensure compatibility. Coordinating field device operations owned by different agencies requires defined procedures for submitting message requests and rules governing when such requests can be honored. Such coordination can be done with informal arrangements such as a Memorandum of Understanding (MOU). Sharing control of field devices operated by different agencies involves more liability issues, which requires more formal agreements. Coordinated incident response may also require formal agreements, but also requires group training of personnel from various agencies. While all interfaces involve agreements for data compatibility, agreements for procedure and operation as well as training can also be critical elements to optimizing the benefits of the architecture.

Table 9 identifies types of potential agreements that could be used by agencies in the region.

Table 9: Types of Agreements

Type of Agreement	Description
Handshake Agreement	• Early agreement between one or more partners • Not recommended for long term operations.
Memorandum of Understanding	• Initial agreement used to provide minimal detail and usually demonstrating a general consensus. • Used to expand a more detailed agreement like an Interagency Agreement which may be broad in scope but contains all of the standard contract clauses required by a specific agency. • May serve as a means to modify a much broader Master Funding Agreement, allowing the master agreement to cover various ITS projects throughout the region and the MOUs to specify the scope and differences between the projects.
Interagency Agreement	• Between public agencies (e.g., transit authorities, cities, counties, etc.) for operations, services or funding • Documents responsibility, functions and liability, at a minimum.
Intergovernmental Agreement	• Between governmental agencies *(e.g., Agreements between universities and State DOT, MPOs and State DOT, etc.)*
Operational Agreement	• Between any agency involved in funding, operating, maintaining or using the right-of-way of another public or private agency. • Identifies respective responsibilities for all activities associated with shared systems being operated and/or maintained.
Funding Agreement	• Documents the funding arrangements for ITS projects *(and other projects)* • Includes at a minimum standard funding clauses, detailed scope, services to be performed, detailed project budgets, etc.

Type of Agreement	Description
Master Agreements	• Standard contract and/or legal verbiage for a specific agency and serving as a master agreement by which all business is done. These agreements can be found in the legal department of many public agencies. • Allows states, cities, transit agencies, and other public agencies that do business with the same agencies over and over (e.g., cities and counties) to have one *Master Agreement* that uses smaller agreements *(e.g., MOUs, Scope-of-Work and Budget Modifications, Funding Agreements, Project Agreements, etc.*) to modify or expand the boundaries of the larger agreement to include more specific language.

In discussing existing agreements, the only ones identified were those regarding maintenance of traffic signals.

The Regional ITS Architecture can be used to determine a set of agreements that may need to be put into place in order to implement the interconnections described by the architecture. Table 10 identifies agreements that may be needed between pairs of stakeholders described in the Santa Fe Regional ITS Architecture. The table was created by identifying element interfaces where the elements are owned, operated, or maintained by different stakeholders. This large list of potential interfaces was then reviewed to remove many of the interfaces between different stakeholders of the same agency, and to remove interfaces that won't need agreements (such as the interface between web sites and the private users that access them).

Table 10: Needs for Future Agreements

Stakeholder A	Stakeholder B	Reason for Agreement
City of Santa Fe	Local Media	Providing emergency and general traveler information.
City of Santa Fe	NMDOT	Requesting archived data.
City of Santa Fe	Santa Fe County Public Works	Requesting archived data.
City of Santa Fe Police Department	City of Santa Fe Department of Planning and Land Use	Providing archive data products.
City of Santa Fe Police Department	City of Santa Fe Public Works Department	Providing archive data products.
City of Santa Fe Police Department	NMDOT	Providing archive data products.
City of Santa Fe Public Works Department	City of Santa Fe Police Department	Requesting archived data.
City of Santa Fe Public Works Department	Local Media	Providing emergency traveler information, road network conditions, and traveler information for media.
City of Santa Fe Public Works Department	NMDOT	Providing maintenance and construction resource coordination, road network conditions, road weather information, roadway maintenance status, and work

Stakeholder A	Stakeholder B	Reason for Agreement
		zone information. In addition, coordinating traffic information and work plans.
City of Santa Fe Public Works Department	North Central Regional Transit District	Providing current asset restrictions, maintenance and construction work plans, multimodal service data, road network conditions, and road weather information.
City of Santa Fe Public Works Department	RECC Stakeholders	Providing emergency traffic control information, incident information, a maintenance and construction response, resource deployment status, road network conditions, road weather information and traffic images.
City of Santa Fe Public Works Department	Santa Fe County Public Works	Providing road weather information, roadway maintenance status, and work zone information. In addition, coordination of maintenance and construction resources, traffic information, and work plans.
City of Santa Fe Public Works Department	Santa Fe Trails	Providing current asset restrictions, maintenance and construction work plans, road network conditions, road weather information, roadway maintenance status, and work zone information. In addition, coordination of transit services.
City of Santa Fe Public Works Department	Volunteer Fire Departments	Providing current asset restrictions and maintenance and construction work plans.
City/County of Santa Fe	City of Santa Fe	Providing evacuation information, incident information, and transportation system status.
City/County of Santa Fe	City of Santa Fe Public Works Department	Providing evacuation information, incident information, incident response status, and transportation system status. Requesting emergency traffic control and a maintenance and construction resource. And, coordinating of emergency plans.
City/County of Santa Fe	County Emergency Management Agencies	Providing transportation system status. Coordinating emergency plans, incident command information, incident responses and resources.
City/County of Santa Fe	County Public Safety Agencies	Providing transportation system status. Coordinating emergency plans, evacuations, incident command information, incident responses and resources.
City/County of Santa Fe	DPS Office of Emergency Management	Providing transportation system status and incident reports. Coordinating emergency plans, evacuations, incident command information, incident responses and resources.
City/County of Santa Fe	New Mexico DPS	Providing transportation system status. Coordinating emergency plans, evacuations, incident command information, incident responses and resources.
County Public Safety Agencies	City/County of Santa Fe	Providing transportation system status. Coordinating emergency plans, evacuations, incident command information, incident responses and resources.
County Public Safety Agencies	NMDOT	Providing emergency archive data and incident reports. Coordinating threat information.
New Mexico DPS	City of Santa Fe Public Works Department	Providing incident information and incident response status.

Stakeholder A	Stakeholder B	Reason for Agreement
New Mexico DPS	City/County of Santa Fe	Providing transportation system status. Coordinating emergency plans, evacuations, incident command information, incident responses and resources.
New Mexico DPS	RECC Stakeholders	Providing incident reports. Requesting hazmat information. Coordinating incident responses.
New Mexico DPS	Regional Medical Center	Providing patient status. Requesting care facility status.
NMDOT	City of Santa Fe	Providing archive data products.
NMDOT	City of Santa Fe Public Works Department	Providing maintenance and construction work plans, road network conditions, road weather information, roadway maintenance status, threat information, transportation system, and work zone information. Coordination of maintenance and constructions resources, traffic information, and work plans.
NMDOT	RECC Stakeholders	Providing emergency traffic control information, road network conditions, and road weather information.
NMDOT	Santa Fe County Public Works	Providing road network conditions, road weather information, roadway maintenance status, threat information, transportation system status, and work zone information. Coordinating maintenance and construction resources, traffic information, and work plans.
North Central Regional Transit District	NMDOT	Providing transit fare schedules, transit archive data, transit incident information, and emergency transit service response.
North Central Regional Transit District	Northern New Mexico Park and Ride Service	Coordinating transit services.
North Central Regional Transit District	Private Information Service Providers	Providing transit and fare schedules.
North Central Regional Transit District	Santa Fe Trails	Coordinating transit services.
RECC Stakeholders	New Mexico DPS	Providing hazmat information and incident reports. Coordinating incident responses.
RECC Stakeholders	Santa Fe County Public Works	Providing evacuation information, incident information, incident response status, and transportation system status. Requesting a maintenance and construction resource.
Santa Fe County Public Works	City of Santa Fe	Providing archive data products.
Santa Fe County Public Works	City of Santa Fe Public Works Department	Providing road weather information, roadway maintenance status, and work zone information. In addition, coordination of maintenance and construction resources, traffic information, and work plans.
Santa Fe County Public Works	NMDOT	Provide road network conditions, road weather information and roadway maintenance status. Coordinating maintenance and construction resources, traffic information, work plans, and work zones.

Stakeholder A	Stakeholder B	Reason for Agreement
Santa Fe County Public Works	RECC Stakeholders	Providing incident information, maintenance and construction resource response, road network conditions, and road weather information.
Santa Fe MPO	City of Santa Fe	Providing roadside archive data. Requesting archive data.
Santa Fe MPO	City of Santa Fe Police Department	Requesting archived data.
Santa Fe Trails	Albuquerque Transit	Coordinating transit services.
Santa Fe Trails	NMDOT	Providing transit and fare schedules, transit archive data, and transit incident information. Coordinating transit services.
Santa Fe Trails	North Central Regional Transit District	Coordinating transit services.
Santa Fe Trails	Northern New Mexico Park and Ride Service	Providing emergency notifications. Coordinating transit services.

12. Using the Regional ITS Architecture

The Santa Fe Regional ITS Architecture has been created, in part, to be used as a key reference in the transportation planning process. This will ensure all proposed ITS projects are consistent with the regional ITS architecture and additional integration opportunities are considered, leading to more efficient implementations.

Planning processes are used to identify projects whose implementation will respond to regional needs. These projects are placed in programming documents such as a Transportation Improvement Program (TIP) in order to secure funding for the projects. Once funded, the projects are implemented. The regional ITS architecture supports all three of these major steps – planning, programming, and implementation

The most important part of developing an ITS Architecture is establishing an approach to using it. An ITS Architecture provides guidance for planning ITS projects within a region or, in this case, the state. It also provides information that can be used in the initial stages of project definition and development.

This section presents the approach for integrating the ITS Architecture developed for the Santa Fe region into the transportation planning/ programming process and leveraging the ITS Architecture project definitions. The approach facilitates and provides a mechanism for the projects identified in the ITS Strategic Plan to be planned and deployed in an orderly and integrated fashion.

The overall objective of an ITS Architecture is to support the effective and efficient deployment of transportation/ITS projects that address the transportation needs of the state. The ITS Architecture focuses on the integration of systems to gain the maximum benefit of information developed in each system and system capabilities across the transportation network. The ITS Architecture defines "what" needs to be put in place to address the needs and requirements of the region. The transportation planning process will leverage the ITS Architecture as a roadmap to project sequencing and interdependency to achieve an integrated transportation system that addresses those strategic objectives.

The primary objective of the ITS Architecture is integration. It is the integration of transportation systems to share information and coordinate activities that facilitates their additional benefits. The Santa Fe Regional ITS Architecture illustrates the information to be exchanged between transportation systems to provide ITS services for stakeholders in the state.

12.1. Using the Regional ITS Architecture in the Planning Process

One of the most important outcomes of the Santa Fe Regional ITS Architecture is that it will be used to plan and deploy ITS across the region. To do this, the ITS Architecture must be integrated into the respective planning processes. As a result of integrating the ITS Architecture into the planning processes, the architecture will link the objectives and strategies of the state with the ITS deployments in the field.

The goal of the planning process is to make quality, informed decisions pertaining to the investment of public funds for regional transportation systems and services. Using the regional ITS architecture to support these planning activities is an important step in the mainstreaming of ITS into the traditional decision-making of planners and other transportation professionals. Once an architecture is complete, it can feed detailed ITS-specific information back into the planning process.

Figure 9 shows some of the key steps in the transportation planning process. These steps will be elaborated on in following sections. The process is driven by a regional vision and set of goals. These drive transportation improvement strategies that are a mix of capital improvements and operational improvements. The planning organizations evaluate and prioritize the various strategies, and the resulting output is a document called the Long-Range Transportation Plan (or sometimes Transportation Plan or Regional Transportation Plan). This plan is the key output of long-range planning

The Long-Range Transportation Plan feeds the Programming function which produces the Transportation Improvement Program. Once a project is programmed then project development can begin. All of these steps occur with a variety of critical factors and inputs as shown in the figure. A regional ITS architecture may support each step in this process.

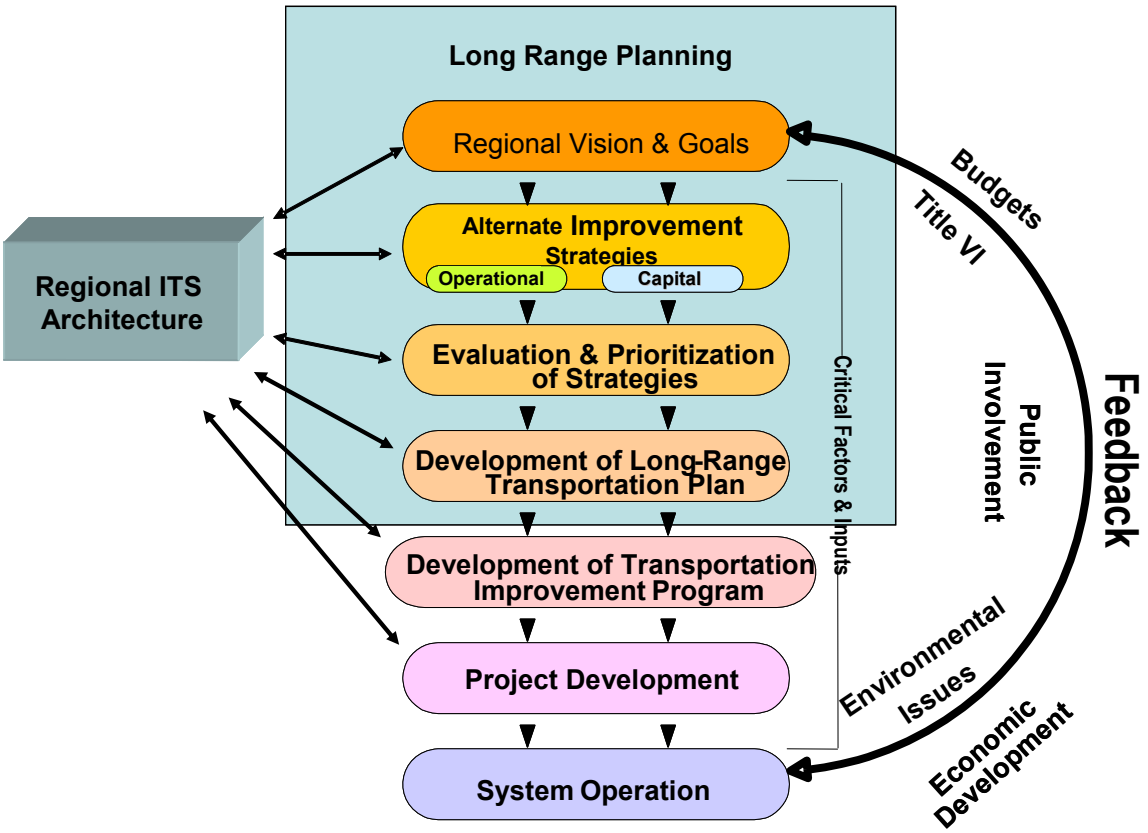


Figure 9: ITS Architecture and the Transportation Planning Process

The long-range plan is the expression of a state's long-range approach to constructing, operating, and maintaining the multimodal transportation system. It is the policy forum for balancing transportation investments among modes, geographic areas, and institutions.
How can a Regional ITS Architecture support the transportation planning process? In the following basic ways that will be expanded upon below:

- The services described in the Regional ITS Architecture can be mapped to operational strategies that can be used to improve the transportation system to meet the region's vision and goals.
- The Regional ITS architecture can be used to support evaluation and prioritization of strategies in two ways. The first is through the definition in the architecture of archiving and data collection systems that support collecting the data needed for evaluation. The second is through the detailed definition of ITS projects and their sequencing that can be used to support prioritization efforts.
- The definition of an integrated transportation system described by the Regional ITS Architecture can support a key element of the transportation plan- for example the element "operations and management of the transportation system".
- The process of developing and maintaining a Regional ITS Architecture can help to enhance the linkage between operations and planning through closer involvement of a wider array of stakeholders from both of these areas of transportation.
-

The discussion below focuses on supporting the transportation planning process at the regional level, but the architecture can be used to support the planning processes in other regional agencies. As shown in **Figure 10**, agencies that do not use federal funds (or operate through the MPO planning process) will still have some form of long range plan and capital plan whose development can be supported by the Regional ITS Architecture.

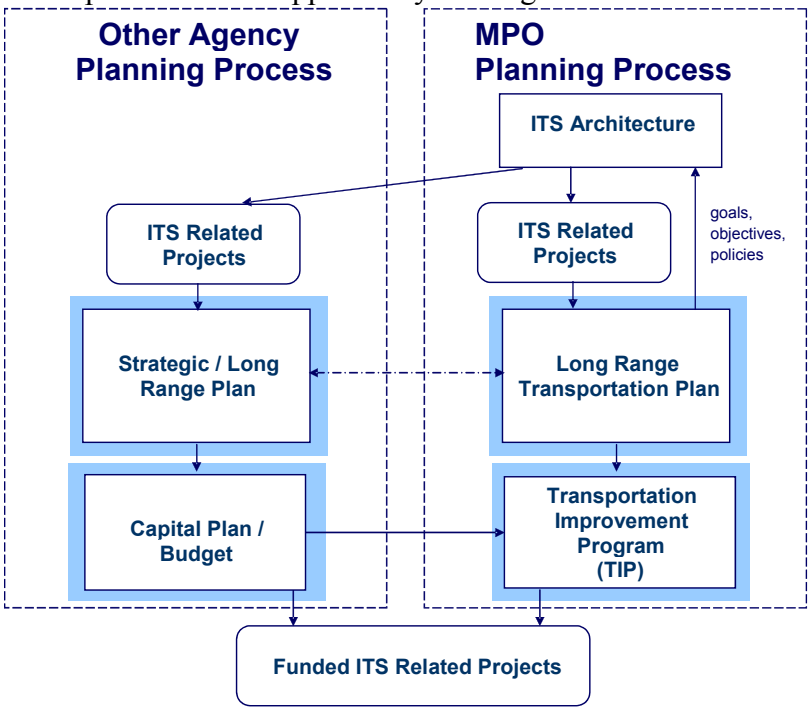


Figure 10. Supporting the Transportation Planning Processes

The challenge for achieving integration across planned ITS projects in the regions is to know how they fit together and interact or depend on each other. The ITS Architecture can be leveraged to bridge the MPO processes to other agencies planning processes that do not use federal funding. If all the processes are using the same reference point, the ITS Architecture, then project integration can start in the planning phase.

Operational Strategies

At the regional level, the planning process begins with a set of guiding principles which are given in the Transportation Plan as:

- Multimodal Transportation
- Partnership with Tribal Governments|
- Environmental Responsibility
- Partnership with Local Governments
- Safety and Security
- Efficient Use of Public Resources
- Economic Vitality

These guiding principles are then further defined as long range objectives and implementation strategies. As shown in Figure 9, the strategies are primarily capital improvements or operational improvements. The Regional ITS Architecture can provide an array of potential operational improvements through the services that are defined in it.

Strategies that have traditional transportation projects as their primary solution may add ITS elements or services as a part of the overall strategy solution. For example, to reduce congestion, a corridor is planned for widening. This project could also include incorporating ITS elements and services to better manage the upgraded corridor.

Strategy Evaluation and Prioritization

Transportation planners use a variety of tools to evaluate and prioritize the various strategies for transportation improvement. Central to this evaluation is the concept of performance measures, which focus attention on the operating performance of the transportation system. The state's ITS Strategic Plan provides performance measures for Operations and Management capabilities provided by ITS services. The performance measures and data collection defined in the regional ITS architecture can provide access to 24/7 data, allowing the planning organization to measure non-recurring congestion, travel times and travel time reliability, and other aspects of system performance and service reliability across all modes.

The Regional ITS Architecture provides a guide for the archiving of transportation data including the collection of data from various ITS operational systems. These archiving capabilities revolve around regional examples of ARC-IT physical object, Archived Data System (such as the NMDOT Crash Database). Furthermore, the Regional ITS Architecture has examples of ITS services such as ITS Data Warehouse (collection of historical data from one or multiple aspects of transportation). The examples of this service describe connections and information that can be useful to planners in performing their evaluation and prioritization efforts. While the automation of data collection for archiving is usually a future activity (or

project), the discussions that occur during the development of the Regional ITS Architecture often present additional opportunities for data sharing that can occur immediately, even before projects for the automation of data sharing are implemented. This sharing of data between operations and planning, as well as the coordination that occurs in the development of the Regional ITS Architecture are examples of linkages between Planning and Operations. The concept of linkage between these two disciplines figures prominently in the FHWA Organizing and Planning for Operations effort (see https://ops.fhwa.dot.gov/plan4ops/index.htm). In recent years a key focus of this effort has been around Transportation Management and Systems Operations (TSMO). The DOT website describes TSMO as:

"The U.S. Department of Transportation Organizing and Planning for Operations Program supports the integration of Transportation Systems Management and Operations strategies into the planning process and transportation organizations for the purpose of improving transportation system efficiency, reliability, and options. This program is led by the Office of Operations and Office of Planning, Environment, & Realty of the Federal Highway Administration (FHWA) in coordination with the Federal Transit Administration (FTA), which work with metropolitan planning organizations, State and local departments of transportation, transit agencies, and other organizations to maximize the performance of existing infrastructure through multimodal and multi-agency programs and projects.

TSMO is a set of strategies that focus on operational improvements that can maintain and even restore the performance of the existing transportation system before extra capacity is needed. The goal here is to get the most performance out of the transportation facilities we already have. This requires knowledge, skills, and techniques to administer comprehensive solutions that can be quickly implemented at relatively low cost. This may enable transportation agencies to "stretch" their funding to benefit more areas and customers. TSMO also helps agencies balance supply and demand and provide flexible solutions to match changing conditions."

The DOT website on TSMO (https://ops.fhwa.dot.gov/plan4ops/focus_areas/integrating/transportation_sys.htm) contains a variety of resources that provide more information.

Additional information regarding the using the regional ITS architecture in planning can be found in *Applying a Regional ITS Architecture to Support Planning for Operations: A Primer,* which can be found at *http://www.ops.fhwa.dot.gov/publications/fhwahop12001/index.htm*.

ITS Architecture outputs, specifically the project sequencing output may also be useful to planning staff as an aid to evaluation and prioritization of strategies. The architecture provides a short-term, mid-term, and long-term, multi-modal view of the ITS systems in the region. It provides the details of the transportation services and functions that can be provided by the stakeholders via ITS projects. The Regional ITS Architecture also illustrates the interfaces necessary between transportation systems to meet the transportation needs of the region. Finally, it translates these details to the definition of a set of projects to be implemented. These projects are grouped by timeframe (e.g. short term, medium term, long term). Key to its usefulness for the strategy evaluation and prioritization (as well as for the LRP as discussed below) is that this list of projects goes well beyond the short term projects that get included in the STIP (see Section 12.2 for a discussion of how the architecture can be used in developing this program element.) The project sequencing contains information for each project that may be useful to the evaluation or prioritization of the projects including:

- Stakeholders involved in the project

- Mapping of the project to ITS Services

Note that this project sequencing is not a replacement for prioritization, but rather, an input to the prioritization process. In some regions, prioritization may already have occurred and be reflected in the project sequencing outputs.

The Regional ITS Architecture provides a guide for how ITS projects can be deployed to satisfy the vision and goals defined as part of the planning process. The architecture provides the details on how ITS can be deployed to meet and satisfy the strategies and transportation services identified for the region. These details may include the interfaces, the operational concepts and agreements necessary to implement the strategies and transportation services. With these details, ITS projects can be more clearly defined, funded, and implemented to satisfy the regional goals.

Multimodal Transportation Plan

One of the primary motives for ITS, and the regional ITS architecture, is the need for more effective management of existing transportation infrastructure. Many regions can no longer rely on adding capacity to keep pace with increasing demand. Instead, they are relying on more effective, integrated management of the existing infrastructure. Recognizing this need, many regions are beginning to include a section of the plan on "Management and Operations", which can be defined as an integrated approach to optimize the performance of existing infrastructure through the implementation of multimodal, intermodal, and often cross-jurisdictional systems, services, and projects. The two most recent transportation spending authorizations, "Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users'' or ''SAFETEA–LU'', and the Fixing America's Surface Transportation (FAST) Act emphasize the need to include Management and Operations in each region's Long-Range Plan. According to the legislation, metropolitan planning areas must include "operational and management strategies to improve the performance of existing transportation facilities to relieve vehicular congestion and maximize the safety and mobility of people and goods." The regional ITS architecture can provide the technical underpinning to this portion of the Metropolitan Transportation Plan.

One of the primary purposes of the Regional ITS Architecture is to define how an integrated transportation system (of ITS elements) might evolve in a region. To do this the architecture describes elements (e.g. various ITS assets) that are interconnected to provide operations and management of the transportation system. The architecture development and maintenance process provides an accessible way for transportation planners to become more focused on integrated management and operations. Operations practitioners have a vision for how this integrated transportation system might evolve, and express this via the details of the architecture.

In the development of the Santa Fe MPO Metropolitan Transportation Plan, some of the outputs of the regional ITS Architecture can be of use in the plan update. The outputs and some indication of their use are:

- **ITS Projects** from the Regional ITS Architecture can provide an input to the Future Projects Matrix of the Multimodal Transportation Plan..
- **Customized Service Packages** from the Regional ITS Architecture offer service-oriented slices of the architecture that facilitate project definition with an understanding of integration necessary to deliver specific services. The service packages provide planners with insight into the ITS elements to include in a project, which will make the project as comprehensive as possible. They also provide sample Implementation Strategies that include ITS to address long range objectives.

12.2. Using the Regional ITS Architecture for Programming

Regional programming and agency capital planning (a.k.a. budgeting) involve identifying and prioritizing ITS projects. The result is funded projects. These processes are shown in Figure 11.

Figure 11: ITS Project Programming/Budgeting/Capital Planning

Using the regional ITS architecture to define an ITS project links the objectives and needs of the region identified in the architecture with the ITS deployed in the field. If projects of the various organizations are defined from the same reference point, the Regional ITS Architecture, then coordination begins in the initial planning and funding phase.

ITS projects in a region may be funded by a variety of sources. ITS projects that are funded with federal funds are programmed by Metropolitan Planning Organizations (MPOs) and NMDOT with input from transportation agencies in the region. All organizations in a region, whether they use federal funds to deploy ITS or not, perform short term planning via their capital planning (i.e. budgeting) process.

Architecture Use in Programming Federal Funds:
The Transportation Improvement Program (TIP) is a staged, multiyear, intermodal program of transportation projects that is consistent with the long-range transportation plan for the state. The TIP assigns federal funding to a prioritized list of specific projects to be constructed over a several-year period (usually three to six years) after the program's approval.

The architecture can be used to define ITS projects that are submitted for federal funding. In the current TIP, ITS projects are not defined in much detail. Sometimes merely a placeholder for ITS projects is included. A benefit to using a regional architecture to define ITS projects is that the projects can be specified in greater detail thereby allowing more realistic estimates of the ITS services being covered by the project.

When project sponsors submit ITS projects for programming, the planning agencies in some states (or regions) require that the sponsors submit architecture-related information about the project. Some agencies merely require yes/no questions to be answered regarding the project's inclusion in the regional architecture while others request more detailed information such as the elements, services, and/or interfaces of the architecture to be deployed in the project. If an ITS project is submitted which is not included in or is not consistent with the regional architecture, a

justification for the project should be required. If it is justified, the impacted stakeholders support the project, and the project is funded, the regional architecture should be revised to incorporate the project.

In the TIP, projects that contain ITS elements should be designated as ITS projects so that projects sponsors are aware of the associated requirements from the FHWA/FTA Regulation/Policy.
The programming process involves prioritizing projects and using federal funds to fund the top priority projects. Each region (and the state) has a process for prioritizing projects. The Regional ITS Architecture can be useful in this process as it reflects the vision for ITS in the region so a factor in prioritization should be how well a project fits within the regional architecture. In some regions, projects (of some categories) are allotted additional points if they include elements or interfaces of the architecture.

Architecture Use in Organization Capital Planning:
All agencies including NMDOT, transit agencies, local municipalities, etc. use a budgeting process to allocate funds to projects. The Regional ITS Architecture includes the existing and planned elements of all stakeholders and how they are or will be interfaced with other ITS elements in the state. Therefore, all organizations can use the architecture to define ITS projects, as defined below, and feed them into their budgeting process.

Many ITS improvements are implemented as part of larger capital improvement projects. As traditional capital projects are defined and programmed, it is important to identify the associated opportunities for efficient ITS implementation. The Regional ITS Architecture is a record of the ITS implementation planned by each agency that can be used to identify these opportunities. Some agencies in other states are considering policies to review each capital project to determine if ITS measures should be included before the project moves forward. Many agencies do this type of review as good practice, but these opportunities would be identified more consistently and "carry more weight" if this check was formally defined and required by an established policy.

Architecture Use to Identify and Define Projects:
A regional ITS architecture includes a sequence of projects. Projects from the architecture should feed into the programming and/or capital planning processes. ITS projects are taken directly from the plan and submitted for funding (with Federal or other funds.)
As the projects defined in a regional ITS architecture are sequenced and have defined characteristics, organizations can use the architecture to define ITS projects to be submitted for funding from any source.

To obtain funding, a project sponsor must define a proposed ITS project. The information contained in the Regional ITS Architecture can be used to define projects with more detail in order to better scope them and establish project budget requirements.
Some potential ways a regional ITS architecture can be used to define an ITS project include:

- Review the list of stakeholders to identify those that should be involved with the project and those that are or may be impacted.

- Use the stakeholder roles and responsibilities defined in the operational concept to clearly define the roles and responsibilities of the stakeholders involved in the project.
- Review the relevant service(s) (i.e. service package(s)) to identify elements potentially directly or indirectly associated with the project and recognizing potential partners to share development costs, material and/or labor, facilities, etc.
- Use the defined interfaces between ITS elements (in the customized service packages) to identify current and future integration opportunities.
- Apply the project description of the project sequencing including costs, technical feasibility, potential institutional issues and readiness to clearly define the project.
- Gain a thorough understanding of the elements and interfaces included in a project to more accurately estimate project budgets.

12.3. Using ITS Architecture in Project Definition

Projects that emerge from the planning process can benefit from the use of the Regional ITS Architecture in their definition and development. Project implementation should follow a systems engineering process. Figure 12**Error! Reference source not found.** shows a typical project implementation process for deploying ITS projects.

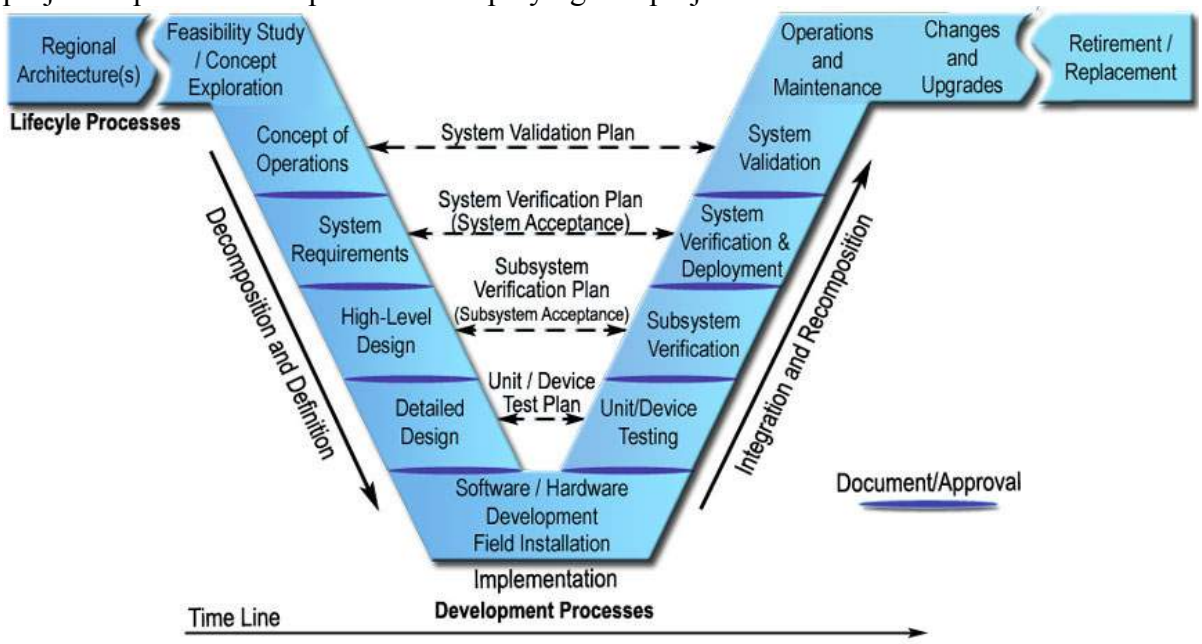


Figure 12. Project Implementation Process

The project implementation process shown in **Error! Reference source not found.** is a systems engineering process. It is a process that can be used to systematically deploy ITS while reducing the risks associated with deployments. The systems engineering process is more than just steps in systems design and implementation; it is a life-cycle process. The process recognizes that many projects are deployed incrementally and expand over time. US DOT CFR 940 requires that the systems engineering process be used for ITS projects that are funded with federal funds.

Applying System Engineering process to ITS project development is a key new requirement that must be addressed by stakeholders using federal funds. The following are some key references that stakeholders can access to assist in using this process:
General Resources

- FHWA Systems Engineering Website (ops.fhwa.dot.gov/int_its_deployment/sys_eng.htm)
- International Council on Systems Engineering (www.incose.org)

Training

- CITE has several Systems Engineering courses that can be accessed at: http://www.citeconsortium.org/cite-courses/bundled-courses/its-systems-bundle/

Publications

- Building Quality Intelligent Transportation Systems through Systems Engineering (FHWA-OP-02-046): www.itsdocs.fhwa.dot.gov/jpodocs/repts_te/13620.html EDL# 13620
- Systems Engineering Guidebook for ITS (FHWA California Division/Caltrans): http://www.fhwa.dot.gov/cadiv/segb/
- System Engineering for Intelligent Transportation Systems, An Introduction for Transportation Professionals http://ops.fhwa.dot.gov/publications/seitsguide/index.htm

12.4. Using the Architecture to Support Development of Systems Engineering Outputs

CFR 940 has a specific set of system engineering analysis requirements that apply to all ITS projects that use funds from the Highway Trust Fund. The required system engineering analysis steps are:

- *Identification of portions of the regional ITS architecture being implemented (or if a regional ITS architecture does not exist, the applicable portions of ARC-IT);*
- *Identification of participating agencies' roles and responsibilities;*
- *Requirements definitions;*
- Analysis of alternative system configurations and technology options to meet requirements;
- Procurement options;
- *Identification of applicable ITS standards* and testing procedures; and
- Procedures and resources necessary for operations and management of the system

The Santa Fe Regional ITS Architecture can provide inputs for the four steps shown in italics in the above list. This section will detail how to obtain that information from the architecture. *In* general, there are two cases to address in defining how to pull information from the architecture:

- The project is in the list of projects contained in Table 8.

- The project is not in the current list of projects

12.4.1. Identifying portions of Architecture Defined by the Project

The first step in the Systems Engineering analysis is to identify the portions of the Santa Fe Regional ITS Architecture that will be implemented by a project

1. **The project is in this list of projects.**

In this case information relating the project to the architecture can be found directly on the hyperlinked website. Select the Projects (or Projects by Stakeholder) Tab. Locate the project in the list and select it. The project details page provides the following information that identifies the portion of the Santa Fe Regional ITS Architecture addressed by the project:

- Stakeholders
- Inventory
- Services

Review the list of stakeholders and Inventory elements and edit as needed (adding or deleting entries as appropriate). Why might the list of stakeholders and Inventory elements not match the project? The lists contain the best understanding of the project at the time the architecture was updated, but the scope of the project may have changed once implementation began.

The Services header shows the customized service package diagrams mapped to the project. Select each and review for applicability. If the entire diagram is covered by the project, then copying the figure from the website (it is in a .gif format) and pasting it into the Systems Engineering Analysis documentation will provide a detailed view of the mapping of the project to the architecture. If the project implements just a portion of the diagram (s) then mark them us as needed to indicate what is covered. This can be done by importing the .gif file to an application like PowerPoint or Visio and performing edits in that tool. If the project as now defined is only partially covered by the architecture, then identify the changes needed to the architecture to fully cover the project (either by text or marked up customized service package diagrams) and notify the Maintenance Manager using the Change Request Form (see Section 13).

2. **The project is not in the list of Projects**

In this case the project is one that was not collected and described directly in the architecture. However, the essential scope of the project may still be included in the architecture. In this case the simplest route is to consider what ITS Services the project will address. On the website select Services (or Services by Stakeholder). Review the list of Services (Service Packages) and identify the ones most closely associated with the project. If you are not sure what a particular service package covers, select the Description Tab under Services, which has a description of each service package. Once you have identified the service package, review the customized diagrams under there for applicability. A selection of Inventory, Stakeholders (can be found on

Stakeholder Tab, or under the Inventory Details pages on the web), and marked up customized service package diagrams represent a detailed mapping of project to architecture.

12.4.2. Agency Roles and Responsibilities

The agency roles and responsibilities can be found in Table 3 of this document. Find the appropriate stakeholder and general area of the project (e.g. Incident Management). Select the roles and responsibilities that most closely address the project and edit or expand as necessary. This information will also be made available as part of the Operational Concepts Tab on the website, which is organized by Stakeholder. Selecting a stakeholder in the project moves to a web page that has general roles and responsibilities of the stakeholder organized into general functional areas (such as traveler information).

12.4.3. Functional Requirements

Finding applicable functional requirements breaks into two cases as described in the section above:

1. **The project is in this list of projects.**

In this case select the project details page (under Project or Project by Stakeholder Tab). This page contains a list of functional areas requirements from the Santa Fe Regional ITS Architecture associated with the project along with a set of functional requirements associated with the functional area. Select the ones considered applicable for the project as now defined. Alternatively, select each element that is part of the project (also on the project details page) and the functional areas/ functional requirements associated with that element are shown. Select those that are appropriate.

2. **The project is not in the list of Projects**

In this case identify the key elements of the project and go to the Inventory ITS Element detail page on the website. This page contains a list of functional areas/ functional requirements applicable to the element based on all the services it supports in the Santa Fe Regional ITS Architecture. Select the subset of these requirements applicable to the specific project.

12.4.4. Standards Identification

Once again, this step breaks into two cases as described above.

1. **The project is in this list of projects.**

In this case select the project details page (under Project or Project by Stakeholder Tab). This page contains a list of Standards from the Santa Fe Regional ITS Architecture associated with the project. Select the ones considered applicable for the project as now defined.

2. **The project is not in the list of projects**

In this case the applicable standards can be found by selecting the Standards Tab and reviewing the overall list of applicable standards for the region. Alternatively, if specific interfaces have been selected for the project, then go to the Element Details page for each project element, select the relevant interface, and select an information flow, which will bring up a details page that includes the applicable standards for that particular information flow.

13. Maintaining the Regional ITS Architecture

The Santa Fe Regional ITS architecture is not a static set of outputs. It must change as plans change, ITS projects are implemented, and the ITS needs and services evolve in the region. This section describes a proposed plan for the maintenance of the architecture. The plan covers the following four key areas:

- Who will be involved in the maintenance of the architecture?
- When will the architecture be updated?
- What will be maintained?
- How it will be maintained (i.e. what configuration control process will be used)?

The regional ITS architecture is created as a consensus view of what ITS systems the stakeholders in the region have currently implemented and what systems they plan to implement in the future. The regional ITS architecture will need to be updated to reflect changes resulting from project implementation or resulting from the planning process itself.

- Changes for Project Definition. When actually defined, a project may add, subtract or modify elements, interfaces, or information flows from the regional ITS architecture. Because the regional ITS architecture is meant to describe the current (as well as future) regional implementation of ITS, it must be updated to correctly reflect how the developed projects integrate into the region.
- Changes for Project Addition/Deletion. Occasionally a project will be added or deleted through the planning process and some aspects of the regional ITS architecture that are associated with the project may be expanded, changed or removed.
- Changes in Project Priority. Due to funding constraints, or other considerations, the planned project sequencing may change. Delaying a project may have a ripple effect on other projects that depend on it. Raising the priority for a project's implementation may impact the priority of other projects that are dependent upon it.
- Changes in Regional Needs. Transportation planning is done to address regional needs. Over time these needs can change and the corresponding aspects of the regional ITS architecture that addresses these needs may need to be updated.

In addition, new stakeholders may come to the table and the regional ITS architecture should be updated to reflect their place in the regional view of ITS elements, interfaces, and information flows.

Finally, ARC-IT may be expanded and updated from time to time to include new user services or better define how existing elements satisfy the user services. This was the case when ARC-IT V8 was released- it added a wide array of connected vehicle services derived from the Connected Vehicle Reference Implementation Architecture (CVRIA). These changes should also be considered as the regional ITS architecture is updated. ARC-IT may have expanded to include a user service that has been discussed in a region, but not been included in the regional ITS architecture, or been included in only a very cursory manner.

13.1. Roles and Responsibilities for Maintenance

Responsibility for maintenance of the Santa Fe Regional ITS Architecture lies with Santa Fe MPO, since they are the primary planning organization for the region, and will be one of the primary users of the architecture. While they assume responsibility for maintenance, it is recommended that a group of core stakeholders act as an "institutional framework" to review proposed changes to the architecture. The regional ITS architecture is a consensus framework for integrating ITS systems. As it was a consensus driven product in its initial creation, so it should remain a consensus driven product as it is maintained. An institutional framework is needed for maintaining the products. This section defines the stakeholders and their roles and responsibilities for the maintenance of the Santa Fe Regional ITS Architecture.

Definitions

The following groups or persons have a role in the maintenance of the architecture:

- Stakeholders – Any government agency or private organization that has a role in providing transportation services in the region.
- Maintenance Working Group – A group of stakeholder representatives who are responsible for the technical review of updates/changes to the Santa Fe Regional ITS Architecture, and for approving changes to go into the architecture.
- Responsible Agency – The stakeholder agency with primary responsibility for maintenance of the architecture.
- Maintenance Manager – The person responsible for overseeing and guiding the maintenance efforts.

Stakeholders

Stakeholders are any government agency or private organization that is involved with or has an interest in providing transportation services in the state. Each stakeholder owns, operates, and/or maintains one or more ITS elements in the architecture.

The success of the change management process outlined in this Maintenance Plan is highly dependent on the participation of the stakeholders identified in the architecture. Without stakeholders participation in tracking the development of they're ITS systems, and properly updating the architecture, the change management process will not succeed and the usefulness of the architecture will diminish over time.

The primary responsibilities of the stakeholder agencies are submitting the changes in plans or projects to the Maintenance Working Group.

Each Stakeholder will designate an Authorized Representative who may make policy decisions for that agency. The Authorized Representative must endorse all changes to the architecture that directly affects his/her agency. The Authorized Representative may appoint a point-of-contact for all other correspondence

If stakeholders desire more involvement, they can get involved through voluntary representation on the Maintenance Working Group.

Maintenance Working Group
The Santa Fe Regional ITS Architecture Maintenance Working Group, or the Maintenance Working Group for short, if SF MPO chooses to create the group would have the following responsibilities:

- Collecting and compiling proposed changes and updates to the architecture from stakeholder agencies.
- Evaluating each proposed change from a technical standpoint, and reaching a consensus on the proposed change.
- Approving changes to the architecture.
- Making any institutional or policy related decisions that arise in the maintenance of the architecture

The logical composition of the maintenance working group for the region is the Technical Advisory Committee (TAC).

Responsible Agency
The Responsible Agency is the government agency that will formally maintain the architecture. The Responsible Agency will assign resources for making the physical changes to the architecture baseline, and for coordinating the maintenance of the architecture. For the maintenance of the Santa Fe Regional ITS Architecture, the Responsible Agency will be the Santa Fe MPO, since they are the transportation planning organization for the region, and will be primary users of the architecture.

Maintenance Manager
The Responsible Agency will appoint a person to the role of Maintenance Manager to coordinate the maintenance activities of the Santa Fe Regional ITS Architecture. The Maintenance Manager will be the coordinator and main point of contact for all maintenance activities, including receiving Change Requests forms, tracking Change Requests, and distributing documentation. The Maintenance Manager is ideally an employee of the Responsible Agency who is formally tasked with the described efforts, but it is not a requirement.

The Maintenance Manager has the following responsibilities:

- Coordinate the activities of the Maintenance Working Group
- Receive Change Request forms and requests for documentation from stakeholders
- Distribute the baseline documents and outputs of the architectures to stakeholders.
- Maintain the "official" records of the Santa Fe Regional ITS Architecture, including the baseline documents, meeting minutes, the Change Request Database, and the list of Points of Contacts for the Stakeholder
- Ensures the status of each Change Request are properly updated in the Change Request Database

Some of these responsibilities will likely be delegated to staff or consultants.

13.2. Timetable for Maintenance

How often will the regional ITS architecture be modified or updated? What events or timetable will be used for making updates or changes to the architecture? The basic approach used by the SF MPO will be periodic maintenance. This approach ties the maintenance of the architecture to one of the recurring activities of the transportation planning process. For example, it's natural that the ITS architecture would be updated at the same frequency as the regional transportation plan is updated (every three to five years). The update of the architecture should occur several months prior to the transportation planning document update, so that the revised architecture could serve as an input to the planning update.

The following approach to maintenance will be used:
A comprehensive architecture update will be performed every three to five years, following the update of the MTP. This is a natural result of the Santa Fe Regional ITS Architecture being a component of the regional transportation planning process. The update is necessary to ensure that the architecture continues to accurately represent the regional view of ITS Systems. The comprehensive update may include adding new stakeholders, reviewing transportation needs and services for the region, updating the status of projects, and reflecting new goals and strategies, as appropriate. Operational concepts, system functional requirements, project sequencing, ITS standards, and list of agency agreements may also be updated at this time.

Between major updates of the architecture, the following interim update actions will be performed:

On an annual basis, the Maintenance Manager will actively solicit changes from each key stakeholder a set of needed updates. The Maintenance Manager will contact the key stakeholders, via e-mail, written correspondence, or by telephone, and inquire if the stakeholder has any changes to the Statewide ITS Architecture. It is the responsibility of the stakeholders to complete and submit the Change Request Forms to the Maintenance Manager for consideration. Within a defined period, the submitted Change Request Forms will be collected and reviewed by the Maintenance Working Group for consideration in the next minor update of the Statewide ITS Architecture.

The Maintenance Plan will also be reviewed at each periodic maintenance to identify any required changes to the Maintenance Plan. Revising the Maintenance Plan will ensure that the change management process defined is effective.

13.3. Architecture Baseline

Establishing an architecture baseline requires clear identification of the architecture products that will be maintained, including specific format and version information. For the Santa Fe Regional ITS Architecture the following outputs are recommended as the architecture baseline:

- Architecture Document (this document)
- Customized Service Package Diagrams
- RAD-IT Database
- Regional ITS Architecture Web pages
- Change Request Database (if developed)

Regarding the Architecture document, the source document, in Microsoft Word format, is held by Santa Fe MPO, while a PDF version of the document is created and placed on the web site for general distribution. In addition, a version number and date will be included inside the cover page.

Regarding the RAD-IT Database, Santa Fe MPO will maintain a zipped version of the final delivered Santa Fe Regional ITS Architecture database. The name, date, and size of the database file inside the zipped file should be entered into an architecture log with the current version.

Regarding the web site, a CD-ROM version of the final web site is maintained by Santa Fe MPO. The version number of the architecture is entered on the home page of the web site so that the version being viewed is immediately identifiable.

13.4. Change Management Process

The change management process specifies how changes are identified, how often they will be made, and how the changes will be reviewed, implemented, and released. The basic process for change management is shown in Figure 13.

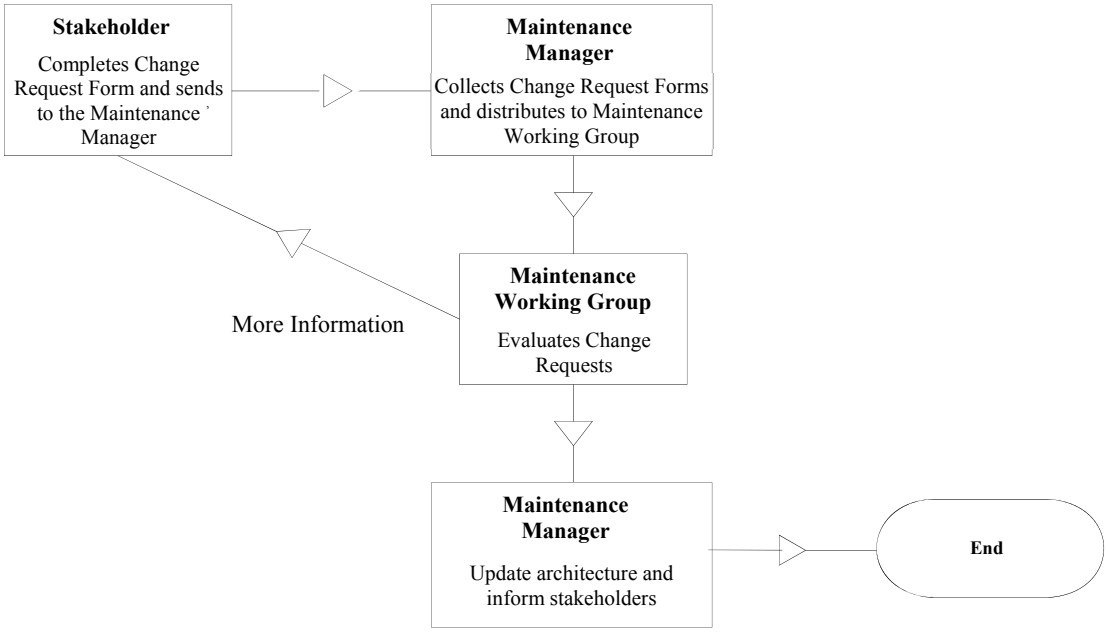


Figure 13: Change Management Process

Identify Change
This involves two issues-

- who can identify a change to the architecture and
- how will the change request be documented.

Any Stakeholder identified in the Santa Fe Regional ITS Architecture is allowed to submit Change Requests. This effectively indicates that all changes have the approval of an existing, defined stakeholder in the ITS Architecture. If the Change Request is to add a new Stakeholder and that Stakeholder's ITS Elements and Interfaces, the Responsible Agency for the architecture will submit the Change Request.

A Change Request Form will be used to submit changes for review. The Change Request Form for the Regional ITS Architecture can be found below. The Maintenance Change Request Form includes the following information:

- Name of change
- Description of change
- Part of baseline affected (could be check boxes for document, database, web site, and not known)

- Rationale for change
- Originator name or agency
- Date of origination

This information will ultimately be added to a change database (recommended to be maintained by MPO personnel) that will add the following additional fields of information:

- Change number (some unique identifier)
- Change disposition (accepted, rejected, deferred)
- Change type (minor or significant)
- Disposition comment
- Disposition date

An example change request form is shown in Figure 12.

Santa Fe ITS Architecture

Change Request (CR) Form

Originator Name:		Date Submitted
Originator Telephone:	Originator Fax:	Originator E-Mail:
Originator Agency:		Revision Type: _____Major _____Minor
Agency Authorized Signature:		Signature Date:

Sponsoring Agency (if applicable):	
Agency Authorized Signature:	Signature Date:

Description of Proposed Change:		
Rationale for Proposed Change:		
Affected Agency:	Authorized Signature:	Signature Date:
Affected Agency:	Authorized Signature:	Signature Date:
List Attachments:		
Baseline Documents Affected: _____ Website _____Turbo Architecture _____Customized MPs _____Document _____Other (describe)		

To Be Completed By Maintenance Manager		
Change Request Number:	Date CR Received:	Date CR Logged:
Date Initially Discussed:	Disposition: ☐ Accepted ☐ Rejected ☐ More Info	Disposition Comments
Date Discussed:	Disposition: ☐ Accepted ☐ Rejected ☐ More Info	Disposition Comments
Date Discussed:	Disposition: ☐ Accepted ☐ Rejected ☐ More Info	Disposition Comments
Date Approved by Steering Committee:		
Baseline Documents Affected/Version implemented ☐ RAD-IT Database Date: _____ Version: _____ ☐ Website Date: _____ Version: _____ ☐ Customized SPs Date: _____ Version: _____ ☐ _____ Date: _____ Version: _____		

Figure 14: Change Request Form

Evaluate Change
Upon receiving a Change Request, an initial evaluation of the Change Request is to be made for the impact to the overall architecture or the affected document. The purpose of the evaluation is two-fold:

- Verify that the Change Request form and supporting materials is complete and correct
- Compare with other Change Request forms and determine if there are any conflicts

If the proposal for architecture modification has an impact on other stakeholders, the evaluator(s) should contact the Stakeholders to confirm their agreement with the modification. All Stakeholders directly affected by the proposed change(s) must approve and sign-off the Change Request before the Maintenance Working Group considers the Change Request.
There are several options as to who performs the initial assessment, including:

- The Maintenance Manager
- Maintenance Working Group
- The person submitting the change
- A consultant, hired to support the maintenance activities of the architecture

Each of the above options has positive and negative implications, but the evaluator must have working knowledge of the architecture to evaluate the proposed changes.

Upon completing the initial assessment, the Change Request form should be reviewed by the Maintenance Working Group (either at a Maintenance Working Group meeting or via some electronic means). Maintenance Working Group meetings are called by the Chairperson (or their designated representative).

Maintenance Working Group meetings called by the Chairperson will occur at least on an annual basis. On an annual basis, the Maintenance Manager will send a reminder to all Stakeholders to update their ITS Elements and Interfaces in the architecture, if necessary. If sufficient Change Request Forms are submitted, the Chairperson may call a Maintenance Working Group meeting at more frequent intervals to review the Change Request forms. The Maintenance Manager will distribute the Change Request forms and all supporting materials to all Stakeholders prior to the meeting for their review and assemble an agenda. Maintenance Working Group meetings can also be requested by one of the stakeholders if there is an urgent need to update the architecture quickly.

The Maintenance Working Group should have sufficient time to review the Change Requests before the meeting. During the meeting, the Maintenance Working Group shall review the proposed changes and offer any comments.

After each Change Request is reviewed, if no further comments are offered by the Maintenance Working Group, the Change Request will be considered approved, and the Chairperson shall sign off on the Change Request.

If additional comments are made that require action, those comments should be noted on the Change Request form. Where comments (or changes required) are minor in nature they can be made by the submitter of the Change Request form, or by resources designated by the Maintenance Manager and the change considered approved. In the case of major comments or changes to the Change Request, the approval of the change may be deferred until the next meeting of the Maintenance Working Group.

If a Change Request is to be withdrawn from consideration, the Chairperson or the Maintenance Manager must sign-off on the Change Request Form to close out the Change Request.
At the end of the meeting, the Maintenance Working Group shall agree if all the approved changes to the architecture necessitate a minor revision of the appropriate baseline documents or a major revision. The decision will be based on the number of Change Requests approved and the nature of the approved changes.

Minutes should be kept for all Maintenance Working Group meetings. Minutes should include, at a minimum, an attendance list, comments made on each Change Request, and the disposition of each Change Request Form (Approved/Withdrawn/Deferred/Request More Information). Minutes are to be distributed to all members of the Maintenance Working Group meeting no less that 5 working days after the meeting. Comments are due within 10 working days to the Maintenance Manager. Approved minutes shall be signed by the Chairperson and will be distributed to all Stakeholders and posted on the website. The minutes provide a recording process for the change management process and provide traceability.

One additional procedure the region may want to consider is to streamline the review and approval process for minor Change Requests, handling via email rather than through face to face meetings.

Update Baseline

If the decision is to accept the change, then the appropriate portions of the architecture baseline are updated and an updated architecture baseline is defined. In addition to updating the baseline documents, databases, or other outputs, the configuration status should be updated. In the discipline of Configuration Management this is known as Configuration Status Accounting. This accounting is performed by having a document that defines the following information for each separate output of the architecture baseline:

- Output name;
- Output revision number;
- Date of latest revision;
- File Name; and
- Location/Point of Contact.

Periodically, the information in the various outputs of the architecture baseline should be audited to assure that the different representations of the architecture information (e.g. the database and

document) are in sync. This configuration auditing should be performed by someone independent of the staff or resources used to actually enter the changes.

Notify Stakeholders:

Point of Contacts for each stakeholder should be notified by e-mail from the Maintenance Manager when baseline documents have been updated. All baseline documents shall also be available to stakeholders from a website or other electronic location, such as an ftp site. It is the responsibility of the Maintenance Manager to ensure the most recent document is available from the website. The Configuration Status Document should be one of those outputs that are available.

Request for copies or access to the baseline documents should be made to the Maintenance Manager.

After major revisions to the architecture or the baseline documents, the Maintenance Working Group may elect to also provide all baseline documents to members on CD-ROMs.

Appendix A- Acronyms

Acronym	Definition
AASHTO	American Association of State Highway and Transportation Officials
ADA	Americans with Disabilities Act
ANSI	American National Standards Institute
APTA	American Public Transportation Association
ARC-IT	Architecture Reference for Adoptive and Cooperative Transportation
ASTM	American Society for Testing and Materials
AVL	Automated Vehicle Location
BIA	Bureau of Indian Affairs
BRT	Bus Rapid Transit
C2C	Center to Center
C2F	Center to Field
CCTV	Closed Circuit TV
CFR	Code of Federal Regulations
DMS	Dynamic Message Sign
DMV	Department of Motor Vehicles
DOT	Department of Transportation
DPS	Department of Public Safety
DSRC	Dedicated Short Range Communications
EMC	Emergency Management Center
EMS	Emergency Medical Services
EOC	Emergency Operations Center
ETA	Expected Time of Arrival
EVS	Emergency Vehicle Subsystem
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
FTP	File Transfer Protocol
GIS	Geographic Information System
GPS	Global Positioning System
HAR	Highway Advisory Radio
HAZMAT	HAZardous MATerial(s)
HMMS	Highway Maintenance Management System
HRI	Highway Rail Intersection
HTML	Hypertext Markup Language
HTTP	Hypertext Transfer Protocol
IEEE	Institute of Electrical and Electronics Engineers, Inc.
ISO	International Standards Organization
ITE	Institute of Transportation Engineers
ITS	Intelligent Transportation Systems
MDT	Mobile Data Terminal
MPH	Miles per Hour

Acronym	Definition
MPO	Metropolitan Planning Organization
MS/ETMCC	Message Set for External TMC Communication
MTD	Motor Transportation Division
NEMA	National Electrical Manufacturers Association
NTCIP	National Transportation Communications for ITS Protocol
OS/OW	Oversize/ Overweight
PDA	Personal Digital Assistant
PIN	Personal Identification Number
PIO	Public Information Office
PMS	Parking Management Subsystem
PSAP	Public Safety Answering Point
RAD-IT	Regional Architecture Development for Intelligent Transportation
RCB	Radio Communications Bureau
RPO	Regional Planning Organization
RTD	Regional Transit District
SAE	Society of Automotive Engineers
SDO	Standards Development Organization
STIP	State Transportation Improvement Program
TCIP	Transit Communications Interface Profiles
TCP	Transport Control Protocol
TDM	Travel Demand Management
TEA-21	Transportation Efficiency Act for the 21st Century
TMC	Traffic Management Center
TMDD	Traffic Management Data Dictionary
TOC	Traffic Operations Center
TRMC	Transit Management Center
USDOT	United States Department of Transportation
VMS	Variable Message Sign
WAA	Wide Area Alert
WAN	Wide Area Network
WIM	Weigh-in Motion
WWW	World Wide Web